# ROADS AND STREETS

*Design, Construction, Maintenance and Traffic Control*

H. P. GILLETTE, *Editor*



*Established 1906*

*Vol. LXX, No. 10*

*Snow Melted Before Side Banks Were Cleared on This Highway Near Sioux Falls, S. D.*

## *October, 1930*



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# ADVERTISERS IN THIS ISSUE

## SNOW REMOVAL SECTION — Pages 69 to 88



***See the Road and Street Catalog & Data Book**

In addition to the advertising messages to be found in this issue of Roads and Streets on the pages as indicated above, condensed catalogs of those marked * as well as other specifications and construction data will be found in the Road and Street Catalog and Data Book, the 384 page annual reference guide for the highway industries, published by the Gillette Publishing Co.

# ROADS AND STREETS

*A Gillette Publication—Established 1906*

*Vol. LXX* *Chicago, October, 1930* *No. 10*


*Rolling Subgrade with 12-Ton Gas Roller*

# *Widening a Mountain Road with* Penetration Macadam Pavement

*Emulsified asphalt used as binder in paving crescent-shaped areas adjoining original surface on curves of Ridge Road across Coast range in California*


*By* S. V. CORTELYOU

*District Engineer, Division of Highways, Department of Public Works, Los Angeles, Calif.*


ONE of the first major projects undertaken by the California Highway Commission shortly after its organization in 1912 was the construction of the Ridge Route as a main artery of travel across the Coast range of mountains between southern California and the great central valley of the state. This road follows the combs of the mountain ridges, adhering to contour alignment for economy in grading, and saved about 50 miles over the shortest road existing at the time of its construction between Los Angeles and Bakersfield.

The road was originally located on standards of 100-ft. minimum radius of curvature (although there are a number of curves from 70 to 90-ft. radius), with 6 per cent uncompensated maximum grade and a roadway width of 21 ft. exclusive of drainage ditches. A large percentage of the alignment was on curves. There are several summits on this route higher than 4,000 ft. above sea level. At times it is subjected to severe storm conditions, especially during the period of winter snows.

*Traffic Forces Improvements.*—The traffic grew steadily, and at present totals from 2,000 to 3,000 vehicles per day, including many slow-moving, heavily loaded trucks and trailers. With the great increase in traffic on the curved alignment and narrow roadbed, the hazard for automobiles to pass slow-moving trucks and trailers was greatly increased, traffic was consequently delayed and an increasing number of accidents resulted. In order to relieve this congestion and delay to traffic, and to provide increased safety to the traveling public, the Division of Highways, Department of Public Works, of the state of California, has had under

way for the last few years a program of increasing the sight distance by widening on the inside of blind curves and of correcting poor alignment on this route.

While this grading work resulted in greater safety and an increased speed in the movement of traffic, it developed a condition of unpaved crescent-shaped areas adjacent to the present 20-ft. concrete pavement, which was placed in 1920. Experimental pieces of various types of surfacing for these "segments" were placed in 1928 and subjected to the very severe traffic conditions on this road. As a result of this experiment, bituminous penetration macadam, using emulsified asphalt as a binder, was finally selected for use on account of its adaptability in meeting the difficult and special conditions. The large volume of heavy loaded truck traffic, coupled with the sharp curvature, demanded a type of pavement which would resist the surface shear as well as carry the heavy loads. Penetration macadam with emulsified asphalt binder was chosen for the pavement.

*Contracts Awarded.*—After these experimental segments had been in place and under observation for nearly one year, a contract was let by the Department of Public Works, Division of Highways, on Feb. 23, 1929, to the Gibbons & Reed Co., of Burbank, Calif., for the paving with penetration macadam of about 6.1 miles of these crescent-shaped areas between ½ mile north of Kelly's and ½ mile north of Sandberg's.

Following the completion of this contract, an additional contract was awarded to the same firm on Sept. 30, 1929, for a continuation of this work from the end of their previous contract to a point 2½ miles north of Sandberg's, a distance of 1.8 miles, making a total length of paving of 7.9 miles under the two contracts.

*Grading.*—The grading work necessary on these two contracts consisted of removing the surplus earth to subgrade elevation, from the crescent-shaped areas, which had been previously excavated to the approximate level of the existing pavement. No large equipment was used, as the grading merely consisted in removing the earth to the outside limits of the segments and utilizing this material to widen the existing embankments and to construct berm banks to protect the embankment slopes from erosion. Fresno scrapers and teams were the only means employed to do this work.

The material encountered and used for the sub-grade consisted generally of sandstone, semi-solidified shale or decomposed granite. However, small sections of clayey material were encountered. Subgrade preparation followed the usual practice of the Division of Highways. Crushed rock for this work was secured by the contractors from a local quarry site situated on the south side of Liebre Mountain, about 1.2 miles from the highway at a point about midway on the contract.

*Depositing Base Course of Rock on Subgrade Using Butler Spreader*

*Plant and Materials.*—The contractor's plant set-up consisted of a Rollerbear 14x28-in. primary jaw crusher and a secondary 10x16-in. Universal jaw crusher. The screen trommel, manufactured by the Austin Mfg. Co., was 12 ft. long by 3 ft. 6 in. in diameter.

Approximately 21,200 tons of crushed rock and 700 tons of emulsified asphalt were used on these two contracts. The specifications for the bituminous binder required that the binder should consist of emulsified asphalt containing not more than 50 per cent water and not more than 1 per cent alkali, clay or other emulsifying agents, and should contain not less than 49 per cent Grade E asphalt with a penetration of from 200 to 250, conforming to the requirements of the state standard specifications. The asphalt emulsion was required to be in a uniformly emulsified condition when applied to the road.

*Original Plans.*—The original plans for this work provided for the following method of construction: The first step was to place a layer of 3½ to 1¼-in. crushed rock, 6 in. loose, on the prepared subgrade; this, after being rolled, would compact to approximately 4½ in. This layer, after being compacted, was to be filled with ½-in. to No. 10 mesh screenings at the rate of 40 to 55 lb. per sq. yard broomed and rolled into the voids.

After the base course was complete, an application of 1 gal. per sq. yd. of emulsified asphalt was to be made. Following this first application of emulsified asphalt, 1¼-in. to No. 10 mesh crushed rock was to be spread at the rate of 65 to 85 lb. per sq. yd., broomed and rolled into the remaining base voids. A second application of the emulsified asphalt was then to be applied at the rate of 1 gal. per sq. yd.

After this second application of emulsified asphalt, the 1¼-in. to No. 10 mesh rock was again to be spread


*Base Course in Place Before Rolling*

—but at this time at the rate of 40 to 55 lb. per sq. yd.—broomed and rolled to fill any remaining voids. The third and final application of emulsified asphalt was then to be spread at the rate of ½ gal. per sq. yd. Following this application of emulsified asphalt, ½-in. to No. 10 mesh screenings were to be applied at the rate of 15 to 25 lb. per sq. yd., broomed and rolled.

This method was used on the first eight segments constructed, but very little locking between the first course of 1¼-in. to No. 10 mesh rock and the second course of the same rock was possible. The side thrust on the sharp curves was so great that it was difficult to hold the material.

*Revised Procedure.*—As soon as the weakness of this procedure was recognized a change was made, and the following procedure followed on practically all of the remaining segments, which method was very similar to

the procedure recommended by the American Bitumuls Corp.

Upon the prepared subgrade a layer of 3½ to 1¼-in. crushed rock was spread by a Butler rock spreader to a loose thickness of approximately 7½ in. It being impossible to roll the segments below the surface of the old pavement, the base was laid in one course. The base course was then rolled until compacted with a 12-ton, 3-wheel gas roller, the thickness when compacted being approximately 6 in.

The crushed rock was then filled with ½-in. to No. 10 mesh screenings at the rate of approximately 30 to 45 lb. per sq. yd., or sufficient, when broomed and rolled into the voids, to fill the lower two-thirds of the base-rock voids. A 8-ton gas tandem roller was used for this rolling.

After this operation was completed, the base was considered ready for the first application of emulsified asphalt, which was spread by a pressure-spraying tan' truck at the rate of 1 gal. per sq. yd. The irregular

*Base Course After Rolling*

area adjacent to the old pavement was spread by a hand hose under pressure. This first application of emulsified asphalt penetrated approximately one-half the base thickness, or 3 in.

After the first application of emulsified asphalt, 1¼-in. to No. 10 mesh crushed rock was spread on the base from the trucks and distributed by hand at the rate of 60 to 75 lb. per sq. yd., or sufficient to fill the remaining voids in the base with a slight excess for smoothing and trueing up the surface. The rock was worked into the voids by brooming and rolling. When all the voids were filled, the surface was dragged by a home-made drag to assist in securing a smooth-riding surface, and

*Base Course Rolled and Filled and Ready for First Application of Emulsified Asphalt*

then again lightly rolled. The 8-ton tandem was used for this operation also.

After the above-described work was complete, a second application of emulsified asphalt was made as before, at the rate of 1 gal. per sq. yd. It was noticed that any excess from this application that was not consumed in coating the rock particles, went on into and penetrated the base further than the preceding application.

The next step was to spread a light application of ½-in. to No. 10 mesh screenings in a sufficient amount to fill the voids in the preceding course without leaving an excess. This amount was found to be from 9 to 13 lb. per sq. yd.

After the screenings were spread the surface was rolled to reset the preceding course. The surface was then broomed and again lightly rolled, and any spots showing an excess or a deficiency in the amount of screenings were corrected. The pavement was then considered ready for the final application of emulsified asphalt.

The final application of emulsified asphalt was spread at the rate of ½ gal. per sq. yd. The surface was then covered with a light covering of dust from No. 10 mesh down, at the rate of 9 to 13 lb. per sq. yd. The surface was then given a final rolling with the 12-ton roller and opened to traffic not sooner than 24 hours after the final application of emulsified asphalt.

*Tests and Conclusions.*—The only weakness discovered in the segments permitting surface moisture to enter, occurred where the pavement was placed over a subsoil of clay with a high shrinkage factor. In such places, tests were made by ponding a pool of water on

*Left—Applying Emulsified Asphalt to Base Course. Right—Hand-Spray Application of Emulsion at Junction of Macadam Work with Old 20-Ft. Concrete Pavement*

the segments, and it was found that where screenings were spread at a rate of less than 10 lb. per sq. yd., the surface was not entirely impervious to water. Where this condition existed, a seal coat was applied at the rate of about ¼ gal. per sq. yd., and was covered with 19 lb. per sq. yd. of ½-in. to No. 10 screenings, which method effectively sealed any weakness in the surface caused by the shrinkage of the subsoil.

Experience on this job showed that it is extremely important that each subsequent application of broken stone shall be interlocked or keyed into the preceding course in order to retard the penetration of the emulsified asphalt to secure a complete covering of all rock particles and prevent the emulsified asphalt from penetrating to the subgrade in such quantity as to be wasted.

*Surface of Completed Pavement, Showing Non-Skid Texture*

A very interesting comparison between the emulsified asphalt and the hot asphalt or road oil was observed in the completeness with which the emulsion covered the rock. As is known, in the use of hot asphalt the section of the rock usually covered is a portion of the sides and top surfaces, while with the emulsified asphalt large base rocks as well as the smaller rocks were practically covered with a coating of asphalt. The only rocks not completely covered were the slab rocks which were encountered occasionally, and even then the emulsion covered all but approximately one-half of the under side.

It was also found that on the final application of screenings there seemed to be no tendency for the emulsion to pond or puddle when an excess was used, but it would penetrate on into the rock to the lower courses.

The American Bitumuls Corp., which furnished the emulsified asphalt for this work, placed two storage tanks on the job with a total capacity of approximately 12,000 gal. A spreading truck was kept on the job and took its supply from these tanks. The tanks were filled before spreading on the job started, and as enough asphalt was removed to make room for another shipment of approximately 20 tons, it was replenished.

A point of striking advantage in the use of cold emulsified asphalt on this job was the lack of inconvenience and danger to traffic due to the absence of the smoke invariably present in the spreading of hot asphalt. On a mountain road of this character, with sharp curvature, steep grades and a condition of more or less blind points, the advantage of a cold asphalt was readily apparent.

This work has now been completed and in use for approximately seven months, and this particular section of road was subjected to very severe snow and rain conditions during the past winter. The work has proved to be very satisfactory, and the only weakness noticeable so far in the finished pavement has occurred in the case of a few segments where some trouble developed because of the lack of adequate subgrade drainage.

# Magnetic Road Sweeper Operations in N. Dakota

A magnetic road sweeping machine was placed in operation last summer on the state highways of North Dakota. The August Highway Bulletin gives the following data on the results obtained during the first two weeks of August:

| | |
|---|---|
| Aug. 1 to 5 on U. S. Highway No. 10, Bismarck to Jamestown. | |
| *Length of section, miles | 88 |
| Lbs. ferrous material collected | 913 |
| No. days operation | 5 |
| Miles completed per day | 17.5 |
| Lbs. material collected per mile | 10.4 |
| Aug. 6 to 11, on U. S. Highway No. 10, Jamestown to Fargo: | |
| Length of section, miles | 96 |
| Lbs. ferrous material collected | 1790 |
| No. of days operation | 5 |
| Miles completed per day | 19.2 |
| Lbs. material colected per mile | 18.6 |
| Aug. 12 to 15, on U. S. Highway No. 81, Fargo south to state line: | |
| Length of section, miles | 76 |
| Lbs. ferrous material collected | 559 |
| †No. days operation | 4 |
| Miles completed per day | 19 |
| Lbs. material collected per mile | 7.4 |
| Recapitulation—Aug. 1 to 15: | |
| Miles covered | 260 |
| Lbs. ferrous material collected | 3262 |
| No. of days of operation | 14 |
| Average miles completed per dav | 18.6 |
| Average lbs. material collected per mile | 12.5 |

*Does not include miles surfaced with oil-mix.
†Includes one day—return trip back to Fargo.

The cost of operation of this unit, including all current operating expenses plus depreciation, amounts to between $1.00 and $1.25 per mile of road swept. It is estimated that approximately 60 per cent of the ferrous material removed is of a puncture producing character.

The machine does not cover the entire roadway surface on one trip. It covers a strip approximately 9 ft. wide and three trips are necessary to thoroughly cover a 24 ft. roadway.

While two trips per year over a highway with this machine will not entirely eliminate punctures, there is no question but what the hazard is greatly reduced.

As stated above, costs per mile, including all current operating expenses plus depreciation of the unit, will run between $1.00 and $1.25. Taking the 184 miles of the gravel surface portion of U. S. Highway No. 10 between Fargo and Bismarck, the cost of one complete sweeping, or removal of 2703 lb. of ferrous material, cost at $1.25 per mile, $230. This section of highway throughout its length carries an average traffic of 600 vehicles per day during the 250 days when the surface is unfrozen, free from snow, and punctures quite likely to occur.

250 days x 600 vehicles x 184 miles amounts to a total of 27,600,000 vehicle-miles per season. $230 divided by 27,600,000 vehicle-miles amounts to a cost of 0.00084 cts. per vehicle-mile for one complete sweeping.

# Joints *in* Concrete Roads

*By* C. N. CONNER
*Associate Editor*

FEW concrete roads, 18 ft. or more in width, are now built without some type of longitudinal joint. Experience and theory have shown that this practice is correct because longitudinal joints control or prevent longitudinal cracking. The types of joint vary as does the size, spacing, length and use of tie bars; there are no fixed standards.

Transverse joints, once popular, then later of doubtful value in the minds of some engineers, are returning to popularity. Expansion joints are used with various types of filler. They are of various widths and there are varying opinions as to their correct spacing; there are no definite standards.

Contraction joints may be cut entirely or partially through a pavement. Here again are no standards either as to type, spacing or usage.

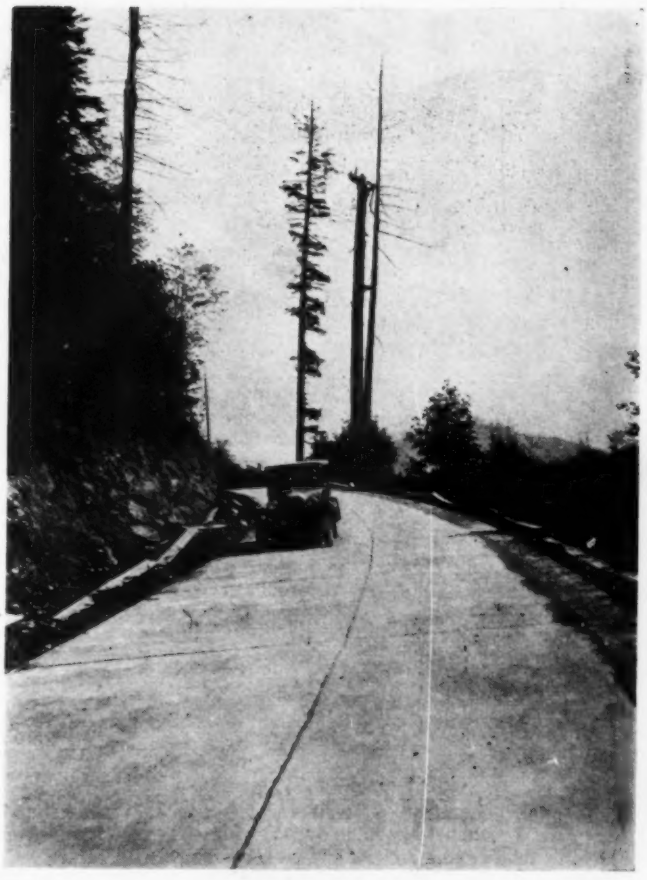
*Joints and Reinforcement Produce Better Service.*—A personal canvass of highway departments in those states which have heavy traffic combined with unfavorable soil and climatic conditions, shows that their concrete pavements which have properly spaced steel reinforcement, and are divided longitudinally and transversely by joints, give far better service than plain concrete without joints.

*Conclusions on Jointing Practice.*—From observations of jointing practice and the effectiveness of joints, made in widely scattered sections of the country, the following conclusions seem justified:

The transverse joint spacing should be from 30 to 50 ft., depending upon soil, climate and subgrade. In the southern states, on subgrades as ideal as those found in South Carolina and Florida, transverse joints might be spaced as far apart as 50 ft. Both these states use a 40-ft. joint interval and have had almost no cracking between joints. It is usually better, however, to make the maximum interval 40 ft. instead of anything greater than that. In Seattle, a joint spacing of 15 ft. has been found necessary. In the state of Washington, they space transverse joints at 20-ft. intervals and have had practically no cracking between joints on the work done in the past several years. On very bad gumbo soils in the middle west and south, a 25-ft. joint interval would probably be needed.

For city work on average soils, it seems best to put joints 30 ft. apart and for country roads on average soils, 35 ft. The shorter slabs are recommended for city pavements because cracks are more objectionable in the city and the property is valuable enough to pay a little extra cost to assure reasonable freedom from cracking. For country roads on very good soil 40 ft. should be a satisfactory joint spacing and on the very best soil, 50 ft. might be justified.

*Wide Expansion Joints Favored.*—The present tendency is toward the use of wide expansion joints spaced at rather wide intervals with one or two contraction joints between them. For slabs laid during the warmer months, a ¾-in. expansion joint at 80-ft. intervals, with one dummy contraction joint at 40-ft. intervals between them, should prove satisfactory wherever a 40-ft. joint spacing would be used. For joint spacing of 30 to 35 ft., expansion joints 1 in. wide at 90 to 105-ft. intervals, with two contraction joints between them, would be recommended. Expansion joints wider than 1 in. have proved unsatisfactory partly because of the difficulty of keeping them filled with expansion material and partly because of the annoying bumps and the resulting impact which wide joints cause.



*Pavement Constructed with Center Joint and Transverse Crack Control*

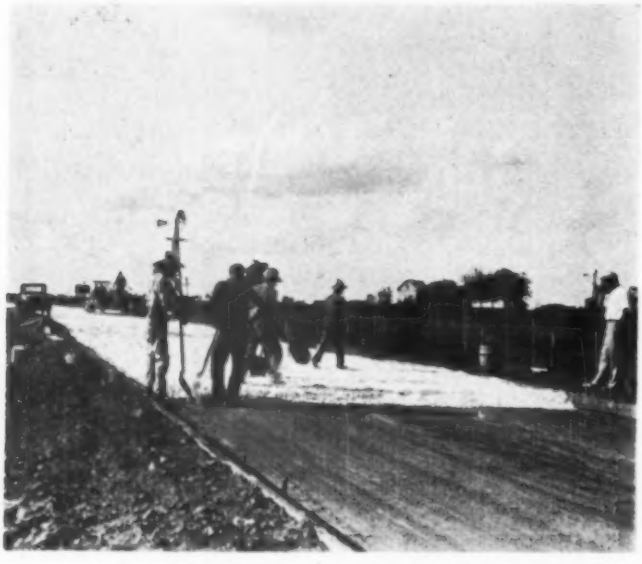
There are no records that indicate the desirability of using different slab lengths with different types of aggregate. Some data has been collected on this subject but it is not complete enough to lead to definite conclusions.

*Temperature Factor and Joint Spacing.*—There is no indication that there should be any difference in joint spacing for slabs laid in cool weather and those laid in hot weather. The crack interval does not seem to depend upon the amount of contraction so much as upon the resistance of the subgrade, the ability of the concrete to stretch without cracking and heaving or settlement of the subgrade. It is customary to allow a 1-in. expansion interval for each 100 ft. of pavement. That is based on a maximum increase in length calculated from a temperature change ranging from 35 deg. F. as the coldest at which concrete could possibly be laid, to 135 deg. F. as the hottest which it would attain even in the southern states. The 1 in. of expansion space also includes an allowance for increase in length due to the absorption of moisture. If the maximum possible expansion for both of these conditions is computed, the total expansion might be 1¼ in. per 100 ft. of slab. Since the hottest day would not be combined with maximum saturation, it is believed safe to recommend 1 in. of expansion interval per 100 ft. of slab. This much expansion has apparently always been sufficient.

# "LONE *Highway* *Presented*

*Sabine River Bridge on Highway 31 Near Gladewater, Completed in 1929. Note Contrast Between New and Old Structures*

*On Highway 35 in Shelby County*



*Above—Spreading Stone in Wilson County*

*Right—Applying Asphalt on Highway 70 in Nolan County. This Shows Special Arrangement of Squeegee Drag on Rear of Distributor*

*On Highway 23 in Baylor County, Completed in June, 1929. This Project Consists of Sledged Stone Base with 2½-In. Asphaltic Macadam Surfacing 18 Ft. Wide*

# STAR"

# *Projects*

# *Pictorially*

*San Antonio River Bridge on Highway 16 Near Falls City, Built in 1929*

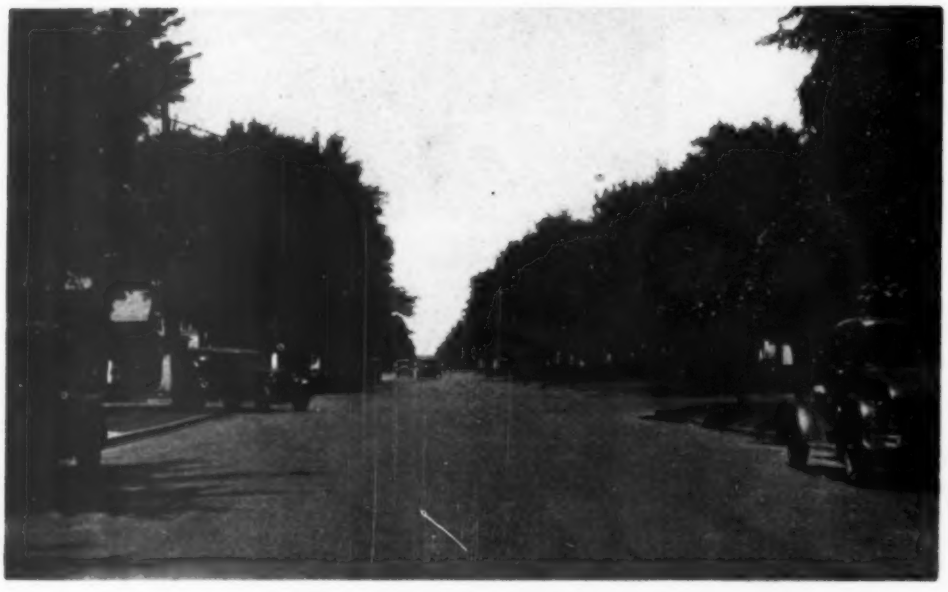
*Pictures from* GIBB GILCHRIST
*State Highway Engineer, Austin, Tex.*

*Painting Center Stripe on Federal-Aid Project No. 182, Taylor County*

*Pouring Concrete on Highway 30, Taylor County*

*On Highway 6 in Harris County. Note the Wide Cross-Section*

# *Resurfacing a Pavement at* LOW COST



*View Taken in June, 1930, of Resurfaced Portion of Johnstone Ave.*

***Small Oklahoma city secures serviceable wearing surface for worn pavement with low expenditure. Surface withstands extreme temperature range***

*By* J. E. McCORMICK
*City Engineer, Bartlesville, Okla.*

BARTLESVILLE, a city of 15,000 people located in the northeastern part of Oklahoma, changed its form of government in 1927 from the commission to the commission-manager type. Ross Taylor, the present incumbent, was selected as the city's first manager. In the reorganization that followed, the city engineer was assigned the additional duties of street commissioner. Bartlesville has approximately 30 miles of paved streets at the present time, consisting of asphaltic concrete, brick and cement concrete, in fairly equal proportion.

Johnstone Ave., one of the most important residential streets in the city was among the first to be hard-surfaced. A rock asphalt pavement laid cold was selected for this avenue. Owing to the great increase in automobile traffic which occurred around this time, it became necessary in 1920 to again improve Johnstone Ave. The old pavement accordingly was resurfaced with a tar surface, 2 in. thick.

In 1929, with funds for street maintenance limited, it became necessary once more to improve the Johnstone Ave. pavement. The street department investigated with a view to securing for a small expediture a serviceable wearing surface for the worn pavement. It was decided finally to employ Texaco No. 45 asphalt cement and chats to form a new mat on the old surface. The method of carrying out this improvement was as follows:

*Methods.*—The equipment used consisted of a kerosene-burning melting kettle with a 110-gal. capacity, a 5-gal. squeegee cart, trucks and small tools. As a preliminary step, the street was carefully cleaned by means of both power and hand brooms, after which the surface was brought to an even contour by filling holes with a mixture of chats (flint mine tailings), sand and asphalt cement. One man, operating the squeegee cart, applied the asphalt at a rate of 0.3 gal. per sq. yd. This was covered immediately with dried chats, 12 lb. to the square yard being distributed by shovels. Chats and sand were dried in an improvised heater after a small portable drier failed to work. Hand screeds were employed to put the finishing touch to the surface. Traffic was then allowed the use of the street.

A second application of asphalt followed, the same quantity being applied as in the first application. This time, however, a covering of sand was substituted for the chats, 11 lb. of sand being spread to the square yard. The second application was rolled with a 5-ton tandem roller, after which traffic was admitted to the street.

*Costs.*—Bartlesville treated 12,588 sq. yd. of old pavement by the above method at the following cost:

| | |
|---|---|
| 31.2 tons of asphalt at $23.30 | $726.96 |
| 153,000 ft. chats at 10 ct. per cwt. | 153.00 |
| 140,000 ft. sand at 10 ct. per cwt. | 140.00 |
| Rolling | 75.00 |
| Fuel, repairs, etc. | 86.78 |
| Labor and supervision | 706.46 |

or a total of 15 ct. per square yard.

The completion of this work was followed by one

of the most severe winters that Oklahoma has ever experienced. For six weeks, all traffic on the new pavement was confined to four ruts cut through the ice to the surface of the pavement. All motor vehicles were using chains and the temperature dropped as low as 24 deg. below zero. The street came through this test with only slight markings from the chains.

This extreme in weather conditions was followed during the summer of 1930 by temperatures as high as 112 deg. F., and the street again stood the test in an excellent manner. The surface is comparatively smooth and this improvement has again made Johnstone Ave. the main thoroughfare to our finest residential district.

▼

## Tandem Paver Operation Speeds Concrete Production

In laying a 4-mile, 40-ft. pavement on Rand Road in Cook County, Ill., the Jaicks Bros. Construction Co. operated two Koehring 27-E pavers, hitched tandem. This unusual set-up enabled the company to turn out 65 to 70 batches of 1-minute mixed concrete per hour, as compared to 45 to 50 batches, the usual output of a single paver with a 1-minute specified mix. By simply adding one operator to the regular crew, the company increased its daily concrete production more than 40 per cent.

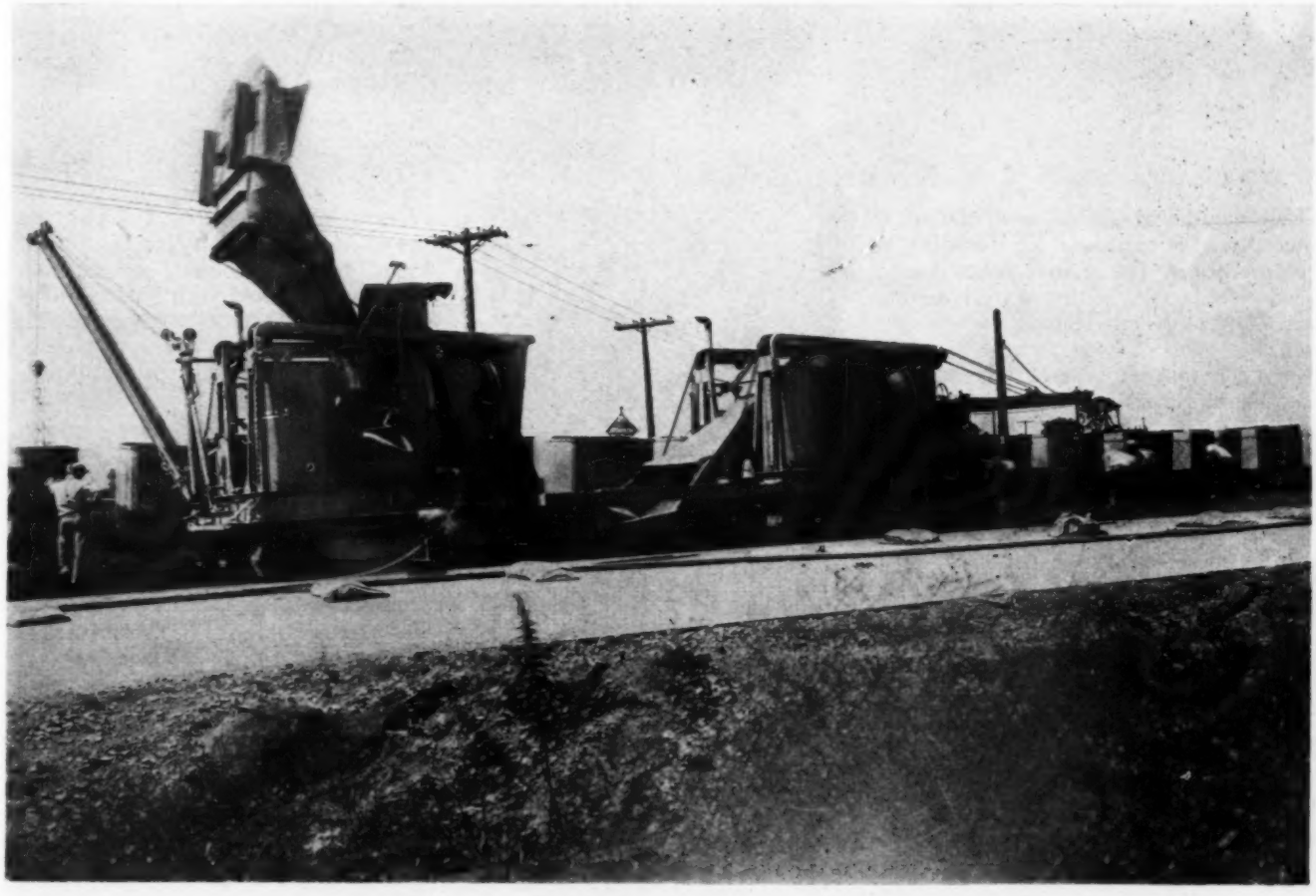
The two pavers are rigidly held a fixed distance apart by a 10x10-in. timber. The distance between the pavers must be kept constant, so that the partially mixed concrete discharged from the first paver will drop into the skip of the second paver without spilling or overlapping.

Materials are proportioned by volume in a central proportioning plant and transported in batch boxes to the first paver by means of an industrial railway. The paver derrick hoists the boxes for charging the skip. All the water is taken into the batch by the first paver which mixes the charge for 26 seconds. The partially mixed materials are then discharged into the skip of the second paver which mixes it an additional 34 seconds—making the total mixing time 1 minute. The resultant concrete is discharged into the distributing bucket of the second paver and placed on the subgrade in the usual manner.

The success of this tandem paver operation has prompted several other contractors to use the same set-up, and it promises to become an important factor in future paving work.

▼

HIGHWAY RESEARCH BOARD MEETS IN DECEMBER.—The 10th annual meeting of the Highway Research Board of the National Research Council will be held Dec. 11-12, at the National Academy of Sciences and National Research Council, B and 21st Sts., Washington, D. C. Studies and reports of developments in many phases of road construction and use will be discussed, including such topics as "Culvert Investigation," "Grading, Subgrade and Drainage," "Climate and Hydrography," "Brick and Block Pavements," "Concrete Pavements," "Bituminous Types of Pavements," "Location, Alignment and Gradient," "Materials and Construction," "Curing of Concrete Pavement Slabs," "Maintenance Costs," "Removal of Ice from Pavements," "Filler for Brick and Block Pavements," "Mechanical Devices for Control of Traffic," "Study of Safety Education Principles" and many other subjects.



*Tandem Paver Operation of Jaicks Bros. Construction Co.*

# Portland Lays First Penolithic Pavement on Pacific

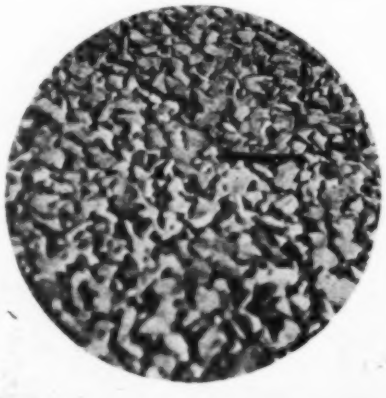
*Marquam Hill Road, Portland, Ore., after Opening to Traffic*

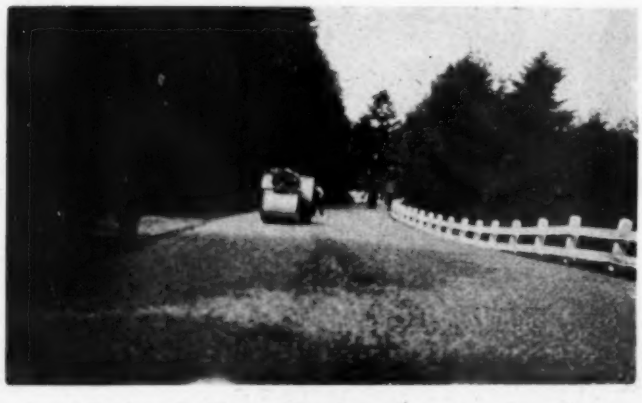
*By* P. McD. FULLER
*Portland, Ore.*

A PAVEMENT which is attracting the attention of many engineers, contractors and state, county and city officials in the far northwest is the new Penolithic pavement on Marquam Hill Road, Portland, Ore. This installation of over 9,000 sq. yd., believed to be the first on the Pacific coast, consisted of the resurfacing of a busy thoroughfare.

Marquam Hill Road leads from Terwilliger Blvd., on a heavy grade and many curves, to the county hospital, Doernbecher Memorial Hospital for Children, University of Oregon medical school and one of the entrances to the U. S. Veterans' Hospital and for many years has been surfaced with waterbound macadam. When resurfacing was decided upon, it was agreed to try out the Penolithic type of pavement, the work to be done with county forces and machinery, under the direction of Warren Bros. Co., of Boston, Mass., developers of the new pavement.

The old macadam surface was thoroughly scarified and broken up with a heavy scarifier pulled by a Caterpillar 60 tractor. A first course of stone was furnished by the county from the quarry and crusher at Kelly Butte and hauled in county trucks. This material ran from 1 to 3 in. in size and was spread evenly on the old surface. The surface was then rolled with a 10-ton roller, following which the voids were filled with screenings obtained from the Columbia Contract Co. and the surface was again rolled with the 10-ton roller. The surface was then sprayed with cold diesel oil by a hand spraying machine, using 1 pt. of oil per sq. yd. of surface, and again rolled with the same roller. Asphalt at a temperature of 425 deg. F. was then applied from a county motor pressure tank at a rate of 1¼ gal. per sq. yd., following which a coating of ¾-in. rock, previously mixed and thoroughly coated with hot oil at the plant of the Columbia Contract Co., was placed on the surface. This material was broomed in until all voids were filled, and the surface was again rolled. A seal coat of hot



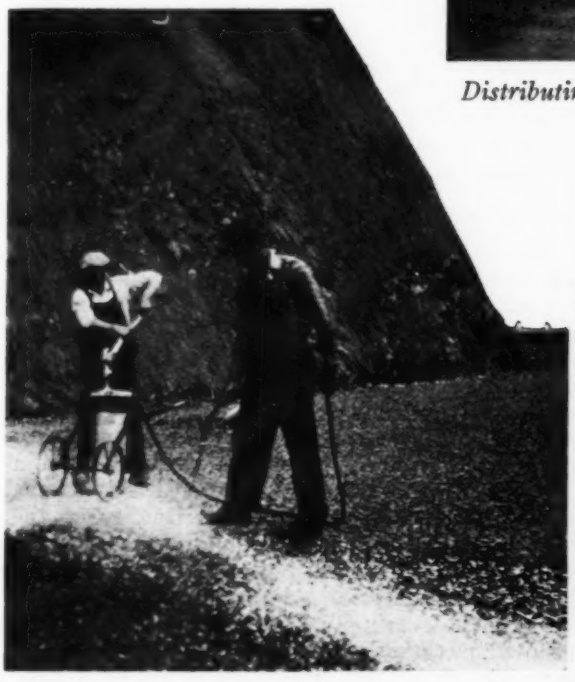


*Left—Spreading Wearing-Course Rock from Dump Trucks. Right—Rolling Wearing Course. In Circle—Close-Up of Rolled Wearing Course*

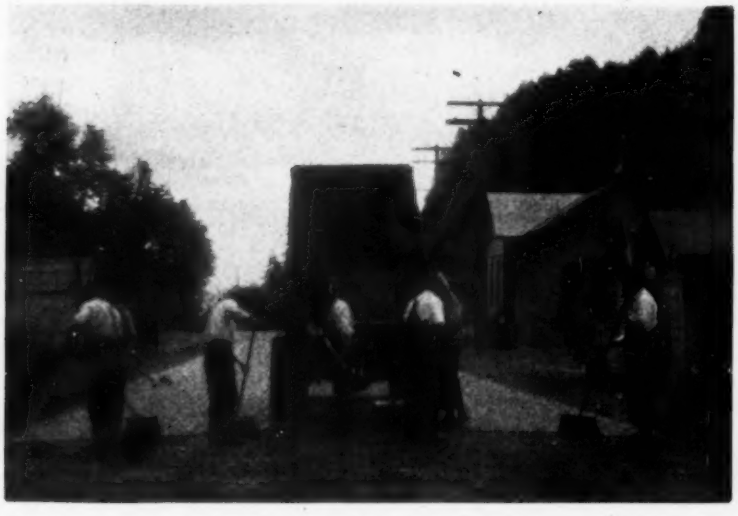
asphalt was then applied at a rate of 1½ gal. per sq. yd., and a non-skid surface was given by a coat of ½ to ¾-in. screenings coated with hot oil.

This work was done entirely with the equipment of Multnomah County, under the immediate direction of F. A. Gilman, of Boston, technical service man of the Warren Bros. Co. For the county, the project was in the hands of George Buck, county engineer and roadmaster, and under the immediate supervision of Henry Moy, district supervisor.

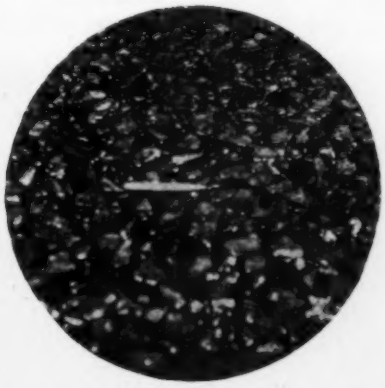
*Distributing Screenings into Base Course with Brooms after Spreading from Dump Trucks*



*Oiling Wearing Course with 4-B Spray Nozzle Attached to Meyers Fruit Sprayer*



*Keying Previously Asphalted Wearing Course with Oiled Stone at Rate of 15 to 25 Lb. per Sq. Yd.*



*Close-up of Wearing Course Penetrated with Asphalt and Rolled with Greased Roller*

*Left—Base Rock with One Coat of Asphalt*

*Right—Pressure Asphalt Distributor, with Supervisor Henry Moy in Foreground*

*Appearance of Base After Filling Depressions and Dragging*

# *Resurfacing a*

## *Repairing and Resurfacing of 8.2 Miles of Route 41 Completed in 30 Working Days and Equipment Described*

*By* L. B. ACKERMAN, JR.
*Bituminous Engineer, Georgia State Highway Department*

AN unusual feature of the resurfacing of Georgia state highway No. 3 (U. S. Route 41) of particular interest to enginers was the method of correcting irregularities in the base before spreading the Kyrock wearing surface. The old base of penetration macadam was badly picked, there being many small depressions averaging 3 to 4 in. in diameter and 1 to 1½ in. deep. In some places depressions ½ to 2½ in. deep would extend as much as 10 ft. As we were using only 80 lb. of rock asphalt to the square yard (¾ in. compacted) it was obvious that these depressions would have to be brought to grade before spreading the surface. This was accomplished by compacting loose Kyrock into the depressions by means of a heavy drag.

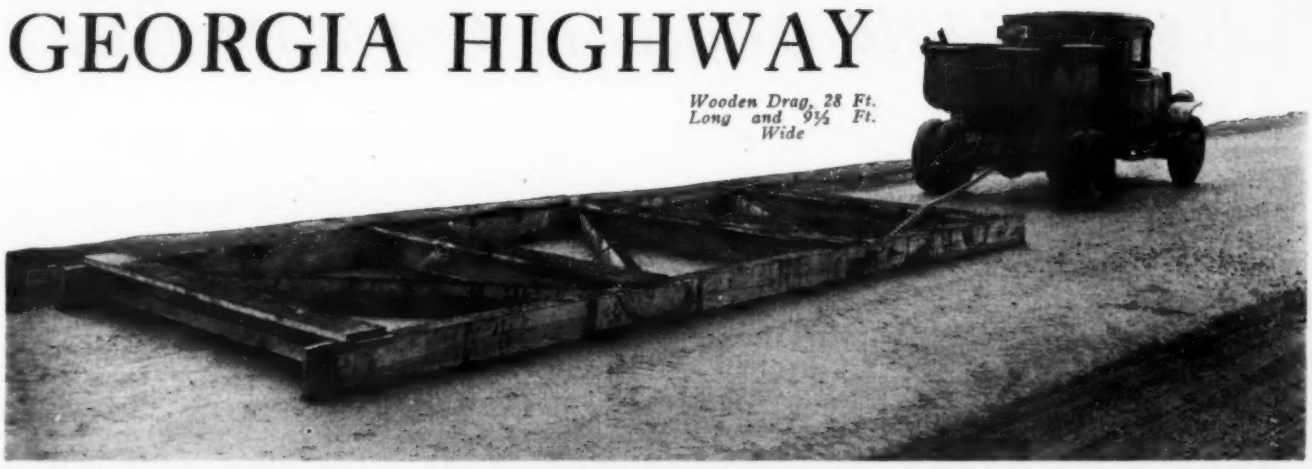
*The Drag.*—This drag, built on the job, was 28 ft. long by 9 ft. 6 in. wide, inside measurement. The side rails were built of three 2x10's spiked together with joints lapped. Cross members were made of two 2x8's. A 2x12 placed on top of each cross member served as a platform for a shoveler. The entire drag was soled with 2x6 wooden shoes, which were renewed from time to time as wear developed. Tow chains were equipped with a slip hook on one end and a grab hook on the other to enable the operator to adjust the pull to conform with the various radii on superelevated curves. The entire structure was well spiked and tied with ½-in. rods to insure rigidity.

*Filling the Depressions.*—A 2-ton truck supplied the tractive power. Loose rock asphalt was thrown over the old base in advance of the drag. It required from 1½ to 8 lb. of rock asphalt per square yard to fill the depressions. The unusual length and rigidity of the drag enabled us to correct the choppy irregularities and bring the long depressions up to perfect grade, thus producing a smooth, uniform surface on which to lay the rock asphalt wearing course. The accompanying illustration shows the appearance of the base after dragging. The light areas show the grade of the old base. The dark areas show the rock asphalt compacted into the depressions by the drag. This operation was done at a labor cost of less than ¼ ct. per sq. yd.

*Placing the Wearing Surface.*—The surfacing material was unloaded from cars with a truck crane into

*Applying and Spreading Surface Course*

# GEORGIA HIGHWAY



*Wooden Drag, 28 Ft. Long and 9½ Ft. Wide*

trucks and dumped directly on to the base. Depth gauges to regulate the thickness of the loose material were made of steel strips ¼ in. by 1¼ in. by 18 ft. A 12-in. section at one end was bent into a tee to prevent overturning. These gauges were laid on the base parallel to the center line on 3-ft. centers. Rock asphalt was then shoveled on to the base and evenly spread by means of triangular wooden lutes operating back and forth on the depth gauges, as shown in the accompanying illustration. The depth gauges were pulled forward as the spreading progressed and irregularities left by the luters were corrected by a 3-in. by 3-in. by 8-ft. wooden lute worked at 45 and 90-deg. angles to the center-line. The forms used on the sides of the roadway were made of 1x4's spiked together at right angles, the flat serving the double purpose of form and depth gauge for the edges and the upright preventing waste of material over the edge while raking. The edges were tamped after the forms were removed and moved forward. The material was rolled immediately after spreading.

*Correcting Depressions and Irregularities.*—A No. 6 Adam maintainer, with blades set to feather-touch, was then worked over the newly rolled surface. Loose rock asphalt, at the rate of 5 to 6 lb. per sq. yd., was cast in front of the blades and this planing corrected all depressions and irregularities left by previous operations. In this work the planer was operated in both directions on the same side of the road, as it was found that operating the planer opposite to the regular direction of traffic corrected base depressions caused by constant one-way traffic. After planing the surface was rolled with a 3-wheeled roller.

Profilometer tests of the completed roadway had not yet been made at the time of this report, although sections of it have been open to traffic for two weeks, but will undoubtedly show a very low roughness factor, as the combined result of dragging the old base and planing the new top was an unusually smooth riding surface. This is an exceptionally fine result, considering the condition of the old base and the fact that we had only 80 lb. of rock asphalt per square yard (¾ in. thick) to work with.

*The Labor Organization.*—Two gangs were used on this work, each gang containing six shovelers, six luters, a form setter, a tamper and float man, one foreman and a roller. Each gang was given the task of laying 1,500 lin. ft. per day and, as a rule, this was completed by 2:30 to 3 o'clock in the afternoon. An 8.2-mile stretch of this road, south of Cartersville, through Emerson, was completed in 30 working days which, in itself, is a speed record in resurfacing.

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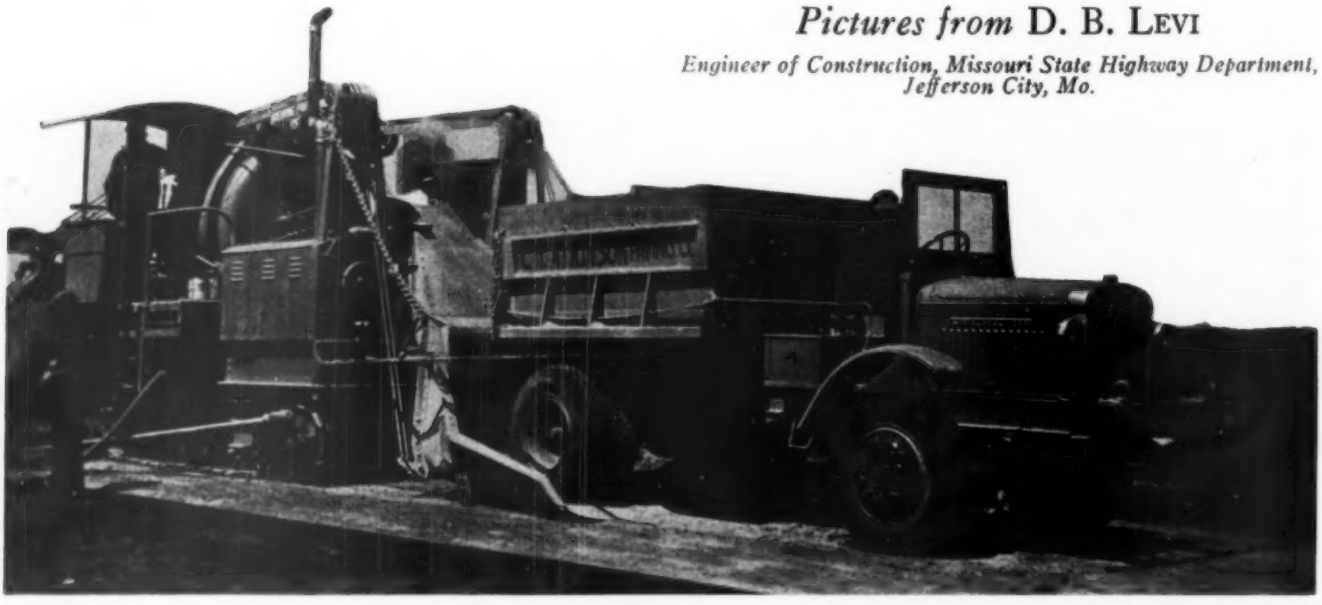
DEPOSITS ON PLANS REQUIRED IN MICHIGAN.—The state highway department of Michigan has announced that hereafter contractors will be required to make a deposit for plans obtained from the office of the chief engineer. The deposit will be refunded to the contractor upon safe return of the plans within 30 days from date of receipt of bids.


*The Maintainer Was Run Over the Roadway from Six to Eight Times*

# *Remarkable Missouri Concrete Run*

*Pictures from* D. B. LEVI

*Engineer of Construction, Missouri State Highway Department, Jefferson City, Mo.*



OUTFIT of the C. H. Atkinson Paving Co. on project No. 232-D in Linn County, Mo., showing Koehring 27-E mixer and Hug truck with side boards, partitioned for three batches. This contractor placed 2,510.3 lin. ft. of concrete pavement from 2:35 a. m., July 3, to 2:24 a. m., July 4, 1930—an interval of 23 hours 49 minutes. Only 58 minutes was lost for equipment repairs. The mixer, running 22 hours 51 minutes, turned out 1,069 6-sack batches on a net interval of 76.95 seconds per batch. All materials were required to be in the mixed drum from 60 to 62 seconds. The quantity of concrete placed and finished in this record run was 1,162.7 cu. yd.

ORD finishing machine on day-and-night record run by C. H. Atkinson Paving Co. A power-line take-off made possible the use of 100-watt lamps at 40-ft. intervals, 5 ft. from the edge of the slab. Carbide lights were also used on the finishing machine to throw direct light on the finishing process.

T. H. Cutler, chief enginer, is watching the final finishing instead of the camera. Murray M. Windle, general superintendent, stands off the shoulder line with his right hand pocketed. C. C. Tevis was project engineer for the state. D. H. Steele was concrete slab inspector and O. W. Morehead was plant inspector.

# Measurements Applied to Sanitation Activities

*Standard Work Units for Street Cleaning, Snow Removal, Refuse Removal and Refuse Disposal, Together With the Various Factors to Be Considered When Comparing Operation Within a City or Between Several Cities*

THE need of developing standard units of measurement, records and costs for street sanitation, has been apparent for many years. It has long been believed that the formulation of a standard procedure for assembling sanitation information would be of great value to the municipal official as a guide for analyzing, controlling and improving the work of his department. The Committee on Uniform Street Sanitation Records of the International Association of Street Sanitation Officials has been studying this problem and has prepared a tentative report which will be submitted at the 11th conference of the association, which is to be held Oct. 9-11 at Louisville, Ky. The report is divided into three parts: (I) The Need of Measurements Standards in Municipal Sanitation, (II) Measurements Applied to Sanitation Activities and (III) Records and Cost Accounting Procedure. The treatment accorded these three parts is but a skeleton of the final draft, but it should at least stimulate further interest and suggestions as well as lend a basis for discussion at the October, 1930, convention of the International Association of Street Sanitation Officials. The matters contained are therefore only preliminary, leaving the way open for continuous revision in the light of experience. The committee plans to publish the final report early in 1931. Part II of the report is reprinted below:

## Measurement of Street Cleaning

The term "street cleaning," as treated in this report, shall include the sweeping, flushing, scraping, or other cleaning of paved streets, lanes, alleys, sidewalks, or other public ways. Street cleaning also includes the collection and hauling away of all sweepings, whether they be placed in piles, deposited in conveniently located receptacles, or emptied from pick-up sweepers and white wing carts at dumps. In some localities, weed cutting, sewer cleaning, road oiling, and other duties are included as a part of the street cleaning activities.

*Curb Mile Unit.*—The work unit tentatively approved as standard for street cleaning is the "curb mile." By the curb mile unit is meant the cleaning of half of the street parallel to each curb line, including intersections, for a distance of one mile. The cleaning of any street a mile long, irrespective of width, therefore, represents two curb miles of streets cleaned. The number of curb miles does not depend whatsoever on the number of passages of equipment on the street, but upon the combined lengths of both curbs. Although the curb does not cross intersections, such distances should always be included in the computation of curb miles, even though duplication of cleaning occurs.

The curb mile unit has been selected because it represents more exactly the amount of work performed than any other unit. It has a distinct advantage over the square yard measure in that the quantity of work and unit costs are not distorted by varying street widths. Under the square yard method, the cost of cleaning a street 60 ft. wide by running a motor sweeper along the two curbs would be half that of cleaning a 30-ft. street, although exactly the same amount of sweeping was done on both streets. Comparisons of the amount of work done and costs of various methods would be meaningless under such conditions. Moreover, it is a difficult task to compute the number of square yards accurately, for it requires a great deal of additional record keeping.

Although the mile unit would give about as accurate results as the curb mile unit, the curb mile seems preferable because it is related more closely to the way the work is done; since under present pavement and traffic conditions, the cleaning of streets has become largely a matter of cleaning the gutter.

The number of curb miles is easily computed from schedules or predetermined routes. The actual curb miles can be obtained for these schedules or routes from engineering plats.

The curb mile unit is not appropriate for cleaning alleys or lanes. Straight miles should be employed where this sort of cleaning is done.

*Application of Curb Mile Unit to Different Methods.*—When motor pick-up machines are used, the curb miles cleaned are determined by the actual miles of curb line along which the machine travels. This is computed in the office from the operator's report turned in daily, which gives complete information concerning the work done. The number of curb miles in regular routes can be predetermined and employed each time the route is covered. Adjustments must be made, however, for any departures therefrom. The readings on speedometers and other measuring devices will serve as a check against the work as reported.

The curb mile unit is likewise applied to hand brooming, hand flushing or white wing cleaning. Hand cleaning should not be treated separately unless it represents a separate cleaning of the streets without the aid of any machines. Although the white wing will pick up deposits in the middle of the street, the work is primarily along the curb. In cases where the white wing patrols the same route day in and day out he should be given credit for the curb miles actually cleaned, whether only part of the route is cleaned or the complete route is cleaned more than once. Where the routes vary from day to day for each man or crew, credit is likewise given for the curb miles of streets actually cleaned.

The curb mile unit applies equally to cleaning streets by machine flushing. In flushing the street, refuse is washed to both curbs where a supplementary operation such as hand brooming or machine sweeping is sometimes necessary to complete the process. A curb mile, therefore, represents the flushing plus any other supplementary methods if any, as may be used to clean a mile of street between the center line and the curb.

The number of passages of the flusher along the street makes no difference in computing the number

of curb miles cleaned. On narrow streets, one passage of the flusher down the center is sufficient, whereas, wide streets may require as many as four passages. It likewise makes no difference when the flusher makes two passages over the same portion of the street, the first for the purpose of loosening the dirt and the second of washing it to the curb. Under any circumstance, the flushing and supplementary cleaning of a mile of street represents two curb miles cleaned. The varying amount of work required by different widths of streets is adjusted in the reports by grouping the streets according to the number of passages. Separate records should be kept for straight flushing and for each distinct combination of machine flusher cleaning, i. e., flushing with hand brooming, flushing with machine sweeping, and flushing with hand flushing. The records should show the amount of work and cost of each operation under each combination.

*Other Factors to Be Considered.*—Although the number of curb miles of streets cleaned by the several methods and their respective unit costs are fundamental to any analysis of street cleaning, they do not tell the whole story. There are many other factors to be considered, and measures which can be applied to various operations. The quality of cleaning, for example, must be considered. Unfortunately, there is no yardstick which will measure the relative cleanliness of streets. Sanitation official must, therefore, be continually critical of the work and use his best personal judgment of results when he is making comparisons between different methods and costs.

Information concerning the width of streets, frequency of cleaning, amount of water consumed, type of pavement, character of refuse on streets, lengths of haul for disposal of sweepings, and other similar factors must be taken into consideration. The type and condition of the pavement largely determines the method or equipment which is most suitable. Obviously streets with a steep grade require less cleaning due to the increased cleaning effect of wind and rain.

The climate and length of the cleaning season also materially affect costs. Northern cities encounter a high labor turnover due to a short cleaning season. Costs are particularly high when equipment cannot be converted to other uses during the winter season. Furthermore, equipment deteriorates more rapidly in damp and cold climates.

The following outline indicates more fully the various factors to be considered when comparing street cleaning operations within a city or between several cities.

I. FACTORS SUBJECT TO GOVERNMENTAL CONTROL

A. Factors within the control of the street cleaning unit:
1. Plan of operations and procedure.
2. Time of doing the work (to a limited extent only, for traffic conditions may govern).
3. Methods and equipment used (to a limited extent, for the type, width, and grade of pavement; climate; and other conditions may govern).

B. Factors outside the control of the street cleaning unit:
1. Type of pavement and state of repairs.
2. Character and amount of traffic.
3. Type of district, wholesale, retail, residence, etc.
4. Character of street refuse.
5. Paved or unpaved condition of intersecting streets.
6. Character and density of population adjacent to streets.
7. Kind and number of trees adjacent to streets.
8. Legislation governing the sweeping and dumping of refuse on to the streets and the enforcement thereof.
9. Standard of cleanliness desired.
10. Local wage scale (to a limited extent).

II. FACTORS NOT SUBJECT TO GOVERNMENTAL CONTROL

1. Climatic conditions (snowfall, rainfall, and temperature).
2. Grade of streets (to a limited extent only).

### Measurement of Snow Removal

Snow removal includes the plowing or removal, either by hauling or chemical treatment of snow or ice on streets, alleys, and sidewalks. Sanding of streets or sidewalks, which is becoming increasingly necessary, also will be considered.

*Miles of Streets Plowed.*—In plowing streets, alleys, or sidewalks the lineal mile unit is proposed. This represents the number of miles the plow actually travels over the established route. This measure is used even though it takes two or more trips on a single street. For example, two trips on a street one mile long represents two miles of streets plowed.

The number of miles plowed is derived from the field reports which show the streets covered by location. The engineering plats or predetermined route schedules furnish the basis for computation.

The removal of snow or ice through the application of chemicals, either during or after the snow fall, is becoming more frequent. Under this method a mile of street to which the chemical is applied is the preferable unit. Additional information concerning the widths of streets, quantities of chemical consumed, the depth of snow, and temperatures will provide a complete picture of the effectiveness of this method of snow removal.

*Cubic Yards Removed.*—The proposed unit for measuring quantities of snow or ice loaded and hauled away is the "cubic yard." This applies whether the snow or ice is loaded by machine or by hand or hauled away in a truck, wagon, or sleigh. The number of cubic yards removed by machine loading should be kept separate from hand loading in order that costs of the two methods may be compared.

If the unit is to be of any value, the exact capacity of the truck or wagon box must be determined and care exercised in estimating the quantity of the load.

*Factors to Be Considered in Snow Removal.*—Accurate comparisons of snow removal are difficult to make even within a given city. The amount of snowfall, the rapidity of evaporation or melting, the character of snow—wet or dry, velocity of wind, temperature, and traffic conditions are never the same during any snowfall. The length of haul, place of disposal, and equipment available also must be considered.

A record of these varying factors and the work performed are indispensable for planning future operations and budget requirements. Comparison between cities will furnish no more than an indication of the amount of effort applied to snow removal, the method of removal, and the total costs. However, the more information available concerning the conditions under which removed, the more valuable will be the comparisons.

### Measurement of Refuse Removal

As used in this report, the term "refuse removal" includes the collecting, loading, and transporting to the ultimate point of disposal all city refuse or wastes including garbage, ashes, rubbish, night soil, and dead animals.

*Ton and Cubic Yard as Work Units.*—The short "ton" (2,000 lb.) has been adopted as the standard unit for measuring the quantity of refuse removed. The only accurate method of determining the volume of refuse is to weigh it. All other methods require

estimates which may or may not be accurate. The number of tons can be obtained easily for garbage and other refuse hauled to incinerators, reduction plants, or hog farms by following the general practice of weighing when received.

Although the cost of a weighing machine may seem burdensome, it is really a very small item when compared to the economies which can be effected through reliable work and cost analyses. Accurate measures of the amount of refuse is indispensable for this.

Where it is impossible to weigh even sample loads of refuse, which is generally the case where the refuse is hauled to a dump, the quantity must be estimated. When it is necessary to estimate, the "cubic yard" unit should be employed rather than tons. Cubic yards can be calculated with a fair degree of accuracy by taking the measurement of the truck, wagon, or trailer, whereas it is practically impossible to estimate accurately the weight of refuse, as it varies for different types of refuse and for the same type during different periods of the year.

*Application of Units to Different Methods.*—Cities vary in their practice of collecting the several types of refuse. Some cities collect garbage, ashes, and rubbish all mixed together; others separate garbage from ashes and rubbish, while still others collect each separately. Many cities, of course, do not collect all classes of refuse. Some cities collect only from households, while others also collect from hotels, restaurants, and other commercial places. The number of "tons," or if weighing is impossible, "cubic yards," should be computed for each type of refuse collected.

The method of removal likewise varies from city to city and even within the same city. Direct haul to the disposal point or transfer is most common, though truck and trailer units are being increasingly employed in larger cities. Supplementary transportation is often needed where long hauls are required to reach the final point of disposal, such as hog farms or reduction plants located at some distance from the city, or where refuse is loaded on barges and dumped at sea. Frequently the wagons or trailers are hauled to a transfer, relay, or loading station where other means of transportation carry the refuse to the place of ultimate disposal. Separate records of the tons collected should be maintained for each method, for each distinct stage in transportation, and for household or commercial service.

*Other Measures and Factors to Be Considered.*—The ton or cubic yard is a reliable measure of the amount of work performed. There are other measures, however, which give a better index to the character of service and which must be taken into consideration when appraising removal operations. The most important of these is the number of households served. The number of regular collections from households when compared with the total number of households needing service furnishes a measure of the completeness of service. The daily report of collections on each route provides the best control over field operations because it shows whether households are actually receiving service. The number of complaints is likewise an indicator of the quality of service.

In analyzing the performance of a refuse collection unit, it is necessary to consider the length of the route, length of haul from the route to the point of transfer or disposal, and where supplementary transportation is required the length from transfer or loading station to the point of ultimate disposal. In supplementary transportation the ton-mile or yard-mile unit may be used as the measure. The density of population vitally affects the amount of work necessary to collect a ton of garbage or to serve a given number of householders. The amount of work per unit also depends upon the number, size, and type of collection units, and the number of collectors to a unit.

Ashes and rubbish are sometimes hauled long distances to reclaim low land or create new land. The profit from such measures may more than offset the increased effort and cost involved.

The following outline indicates more fully the various factors to be considered when refuse removal operations are being studied or when comparisons are made either within a city or between cities.

I. FACTORS SUBJECT TO GOVERNMENTAL CONTROL
- A. Factors within the control of the removal unit:
  1. Plan of operations and procedure.
  2. Methods and equipment used (to a limited extent, for grade and conditions of pavement and degree of separation of different classes of refuse may govern).
  3. Policy of transferring refuse between point of collection and delivery point.
- B. Factors outside the control of refuse removal unit:
  1. Haulage distance—availability of disposal sites.
  2. Quantity of refuse at points of collection.
  3. Type and capacity of containers.
  4. Whether house refuse is collected from curb or from premises.
  5. Degree of separation of different classes of refuse.
  6. Extent and condition of pavement.
  7. Density of traffic over haulage route.
  8. Standard of cleanliness observed in collection and hauling.
  9. Local wage scale (to a limited extent).
  10. Breakdown of disposal plant.

11. FACTORS NOT SUBJECT TO GOVERNMENTAL CONTROL
  1. Climatic conditions (snowfall, rainfall, and temperature).
  2. Grade of streets (to a limited extent).
  3. Distance refuse must be hauled to point of disposal (to a limited extent only).
  4. Extent to which alley collection is possible.
  5. Density of population.

## Measurement of Refuse Disposal

By "refuse disposal" is meant the ultimate disposition of all municipal refuse including garbage, ashes, rubbish, night soil, and dead animals disposed by dumping, burial, hog feeding, incineration, reduction, or other method.

*Ton and Cubic Yard as Work Units.*—The same work units used for the collection of refuse naturally apply to measuring the amount of refuse disposed. In fact, the measure of the amount of refuse collected is used by nearly all cities as the amount disposed, or vice versa. The "ton," therefore, is the standard unit to be employed with the "cubic yard" as an alternative unit when it is impossible to weigh even sample loads.

Separate records should be kept of the amount of each type of refuse disposed under each distinct method. The records should show the amount disposed on each dump and costs of maintaining dumps. Due to the complexity of operation, incineration and reduction plants require additional records, covering such items as tons of refuse disposed, analysis of composition, sorting of rubbish, amount of ash or by-product obtained, amount of coal or electricity per ton of refuse disposed, etc.

Removal and disposal records should be coordinated sufficiently that a unified picture of the whole process can be obtained. As the method of collection is in part dependent upon the type of disposal, comparisons cannot be made either within a city or between cities without viewing the process in its entirety.

*Factors Affecting Disposal.*—The various factors to be considered in analyzing refuse disposal operations are indicated in the following outline:

I. FACTORS SUBJECT TO GOVERNMENTAL CONTROL
- A. Factors within the control of the refuse disposal unit:
  1. Plan of operations.
  2. Type of plant or equipment (other governmental agencies or availability of disposal sites may govern).
- B. Factors outside the control of the refuse disposal unit:
  1. Degree of necessity for suppressing odors.
  2. Proportion of different classes of refuse.
  3. Local wage rates (to a limited extent).
  4. Cooperation by the refuse removal unit.

II. FACTORS NOT SUBJECT TO GOVERNMENTAL CONTROL
1. Weather conditions (rain, snow, temperature).
2. Seasonal variations affecting composition or quantity of refuse.
3. Physical characteristics of city which may partly determine location and nature of disposal works.

### Measurement of Catch Basin Cleaning

By "catch basin cleaning" is meant the removal and disposal of all refuse from the catch basins whether on paved or dirt streets and regardless of methods employed. Thawing or opening of catch basins to allow drainage of streets is also included. Some cities use a direct inlet to their sewers without catch basins and therefore will not be concerned with this subject.

The most practical work unit for catch basin cleaning is the "cubic yard," for it is not feasible to weigh these cleanings which consist largely of common dirt. The cleanings are usually hauled to a dump or low lots. When loaded on trucks, wagons, or trailers, the number of cubic yards must be estimated. Educting machines are gauged so that the amount removed in cubic yards can be determined with a high degree of accuracy.

By supplementing the report with a statement concerning the size of catch basins and number of clean, ings, a complete analysis may then be made of catch basin cleaning operations. To this end unit costs can be computed per catch basin cleaned once as well as per cubic yard removed. Separate records should be maintained for hand and machine methods. Records should likewise be kept of inspections.

Conditions affecting catch basin cleaning must be considered in studying this problem are:
1. Size and type of basins.
2. Capacity of sewers.
3. Grade of streets.
4. Rain and snow fall.
5. Character of street refuse.

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## International Road Congress Delegates to Visit Milwaukee

The Western tour of the delegates to the International Road Congress will include Milwaukee, Wis., which will be visited on Oct. 15, for a study of modern road equipment and methods used in the construction of highways.

At first it had been planned to omit Milwaukee from the itinerary, but a special delegation to Washington and conferences with authorities convinced the latter that Milwaukee has an obligation to take part in the reception of the foreign guests. Plans were immediately changed and the delegation was re-routed to include Milwaukee.

The delegation will be received at Chicago on Oct. 15 where they will board a special solid Pullman train leaving for Milwaukee at 8:00 A. M. Breakfast will be served enroute. Chair, lounge and observation cars will provide additional travel comfort.

Arriving at Milwaukee, the train will stop alongside the beautiful Lincoln Memorial Bridge and Drive at the shore of Lake Michigan opposite the passenger terminal and in the heart of the city's landscaped front yard, where an exhibit of all Milwaukee road equipment will await inspection. Two hours will be spent in examining these products ranging from a hand pick to mammoth power shovel and including all intermediate power driven construction tools and motors.

The delegation will then have luncheon at one of the prominent hotels where they will be briefly addressed on Milwaukee and Wisconsin subjects by Morton R. Hunter, General Chairman of Reception, Walter J. Kohler, Governor of Wisconsin, William F. Eichfeld, President, Milwaukee Association of Commerce and head of the structural firm bearing his name, and by Jerry Donohue, Chairman, Wisconsin Highway Commission.

Following luncheon, the delegate-guests will be conveyed in special buses upon a scenic and educational highway tour to Madison, a distance of 85 miles. This portion of the program will be guided by Commissioner Donohue and aides to afford the visiting engineers opportunity to study all classes of road construction in use in the country. Dinner at Madison and a sightseeing trip of the Capitol city will be followed by entraining for the twin cities, Minneapolis and St. Paul.

The entire program manifests the far-sightedness and cooperative policies of Milwaukee industrialists and bespeaks the continued success of host companies which include the Allis-Chalmers Mfg. Co., Blackhawk Mfg. Co., Bucyrus-Erie Co., Butler Bin Co., Chain Belt Co., Harnischfeger Corporation, The Heil Co., Highway Trailer Co., Hunter Machinery Co., International Harvester Co., Le Roi Co., Metal Form Corporation, National Brake & Electric Co., National Equipment Corporation, Nordberg Mfg. Co., Perfex Corporation, Sterling Motor Truck Co., Sterling Wheelbarrow Co., Trackson Co., Unit Corporation of America, Waukesha Motor Company, Wehr Company and the Wisconsin Motor Manufacturing Company.

It is not the thought of the foregoing to get across their individual message, but rather to impress the visitor that Milwaukee, although an important industrial center is not too busy to preclude its being a friendly community.

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## Michigan State Road Show

The Michigan Road Show, under the auspices of the Michigan Association of Road Commissioners and Engineers and the Michigan State College, will be held at East Lansing in the Demonstration Building on the college campus, October 28th, 29th and 30th, of this year.

It is expected this will be the largest road show ever held in Michigan. In addition to the 22,000 sq. ft. of floor space utilized at last year's show, 8,400 sq. ft. have been added. Arrangements have been made with the college authorities to take care of the demonstration of all makes of machinery on the campus and roads immediately adjoining the Demonstration Hall.

It is stated that last year there was practically 100 per cent attendance of county road commissioners and road and street contractors, and nearly one-half of all the township highway commissioners in the state. From the reports now being received it believes this year's attendance will be greater than that of last year. H. J. McKinley, 1500 Scribner Ave., Grand Rapids, Mich. is manager.

# Iron Plates as Experimental Base for Brick Surface

*New idea, put to test in Illinois, interests highway engineers*

*By* VICTOR J. BROWN, *C. E.*
*Associate Editor.*

IRON or steel as paving is not a new idea. Even in combination with other materials iron and steel have been employed for building roadways. But the idea of using iron plates as a base or foundation for a brick or bituminous type pavement is new. An experimental section, 150 ft. long, on which ingot iron plates form the base, has just been built on the Rochester-S. Grand Avenue road, running east from Springfield, Ill.

This short section, because of its novel design, has attracted national attention. Many officials of the iron and steel, brick, cement and protective-coating industries were present during the construction of the test section as well as engineers, state and county highway officials and contractors. Right here may it be stated

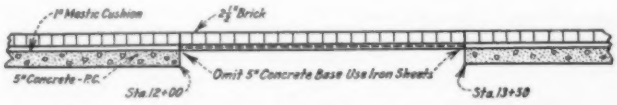


*Fig. 1—Showing Location of Test Section*

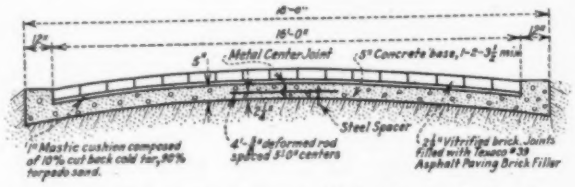


*Fig. 2—Cross Section of Main Part of Road*


*Fig. 3—Cross Section of Part of Experimental Length*

that there were as many different ideas as to how those plates should have been made and placed as there were visitors to the site. However, a start had to be made and one design adopted. There is no telling what may develop from this experiment. It appears to possess merit and possibilities. As shown by Fig. 1, the section extends from Sta. 12+00 on the west to Sta. 13+50 on the east. The main part of the road consists of 16 ft. of brick surface on an 18-ft. concrete base with two 12-in. monolithic concrete curbs. Figure 2 is a cross-section of this, while Fig. 3 shows a cross-section of Section A of the experimental length. The experimental base is divided into three 50-ft. sections which differ somewhat from one another. For convenience we shall call them Section A, Section B and Section C, in the order in which they were laid from east to west.

*Protective Coatings.*—The plates of all three sections were not coated with the same protective material. They were all coated on the under side and the T-bars were coated all over. Nitrose, which was used on the plates and bars of Section A, is shown being applied in Fig. 4. It is a gas-house tar, chemically treated. No-Ox-Id was used on Sections B and C. This pro-

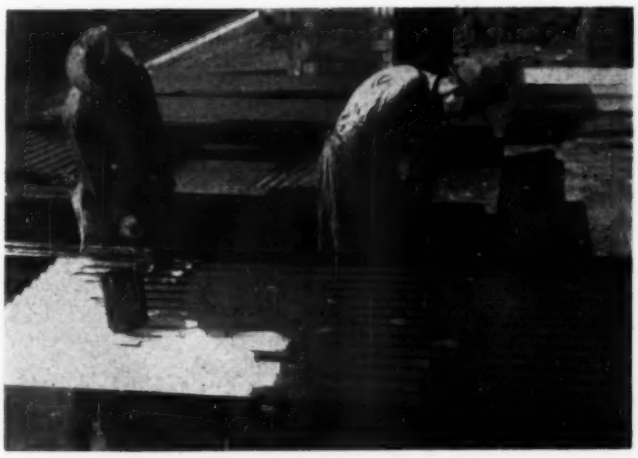

*Fig. 4—Applying Nitrose Protective Preparation to the Sheets of Section A*

tective preparation is a three-course process. First a pasty or greasy gray-green compound is smeared on with brushes as shown in Fig. 5. Then a covering of treated muslin, Fig. 6, is applied. The treatment given the muslin is a thorough impregnation with the same greasy preparation as was spread on the plates and bars. Then the third covering given is a black paint-like substance that was spread over the other two courses. This is shown by Fig. 7.

*Subgrade.*—Because of rain on Sunday, Sept. 14, 1930, the entire subgrade was quite muddy. The afternoon of the following day the contractor, the Sangamo

**DATA ON PLATES**

| Section | Station | Plates | No. | Thickness | Coating | Structural Steel |
|---|---|---|---|---|---|---|
| A | 13+00 to 13+50 | Corrugations Longitudinal | 30 | 10-gauge | Nitrose | 5—4"x3"x⅜"x18'0" T-bar transverse<br>2—3"x3"x¼"x50'0" angles longitudinal |
| B | 12+50 to 13+00 | Corrugations Transverse | 30 | 10-gauge | No-Ox-Id | 1—4"x3"x⅜"x50'0" T-bars longitudinal<br>1—4"x3"x⅜"x18'0" T-bar transverse |
| C | 12+00 to 12+50 | Flat | 20 | ¼" | No-Ox-Id | |

Construction Co., put a crew on the fine grade and, after dressing to form, rolled it while yet quite moist. The effect of the rolling was to seal the surface in a degree, thus preventing a thorough drying by noon of Tuesday, when the transverse T-bars of Section A were imbedded in it. These were placed with the stem of the T downward and the bar of the T flush with the subgrade. Fig. 8 shows the third T-bar being placed. Men are standing on the ends of the first two placed. They were checked in each case with the template. Tuesday afternoon it was possible to stand on

*Fig. 5—Applying the First Coat of No-Ox-Id*

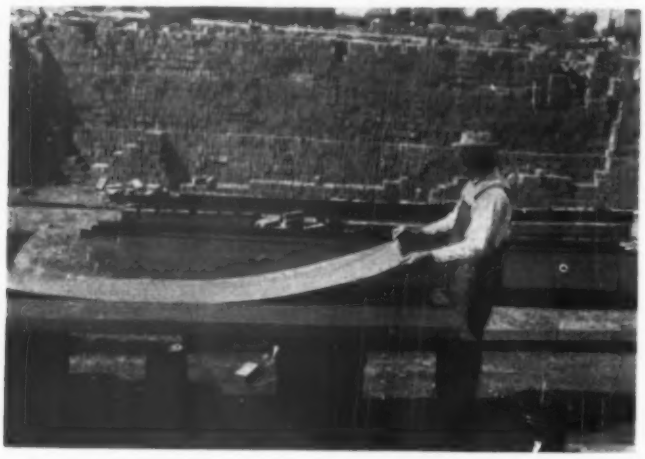

*Fig. 6—The Second Course of the No-Ox-Id Treatment*

*Fig. 7—Painting the Third Coat of the No-Ox-Id Protective Preparation to Sheets of Section B and C*

most any part of the subgrade and by treading up and down on the same spot create quite a spongy condition. However, Wednesday, just after noon, when this test was given, the soil appeared firm. A hard crust had formed because of the rolling. The last of the T-bars for both Section A and Section B were in place by Wednesday noon. In Section B a long T-bar runs down the center-line of the road subgrade from the last transverse T-bar of Section A to a transverse T-bar that is imbedded between Section B and Section C as a support for the last plates of Section B. All T-bars for the middle section were welded together at points where they met, as were the angle irons that form the curb on each side.

*Iron Base.*—Wednesday afternoon the first corrugated plates were laid. They are 10-gauge Armco ingot iron and were painted on the under side with a coating of Nitrose. The plates were taken from standard stock sizes for this experiment so that five full sheets and a fractional one are required in Section A to make one row 10 ft. long the width of the pavement. Each overlaps the next one to it by a corrugation. There are five of these rows butted end-to-end, resting on T-bars. The corrugations on this section run parallel to the center-line of the highway. To bed each one it was necessary to cut a slot into the subgrade to receive the turned-down part of the plate. Each sheet as it was placed was then tamped to as good a bearing as could be secured by tamping. Some of the plates did not rest firmly on the transverse T-bar so it was decided that they should be spot-welded to it as well as being spot-welded to one another.

Even after the spot-welding it was possible to cause the plate ends to move vertically past one another by throwing the weight of the body first on one foot and then on the other when straddling some of the butt joints. This condition could not be entirely eliminated for two reasons:

1. Each plate overlapped its neighbor by one corrugation, thus raising one edge off the T-bar by the thickness of the plate.

2. Some of the plates were arched a bit due to manufacturing processes or handling. It was thought possible to overcome the movement, above stated, by throwing a half-inch of loose dirt on the subgrade. This was done for the last row of plates in Section A. By considerable tamping the loose earth was worked into the corrugations, thus producing a better bedding. But the movement of plate ends was not entirely eliminated.

In the middle section, Section B, the plates are placed transversely to the roadway. Hence the corrugations are transverse. One end of a sheet thus rests on the T-bar going down the center of the subgrade. The other end rests on and is welded to an angle iron which serves as the curb to hold the brick and cushion in place. As in the first section, the sheets were overlapped one corrugation, but at right angles, of course, to the overlap that occurs in Section A. They are butted together down the center-line and spot-welded to the T-bar and to each other. Provision for expansion is made between sections and at each end where the iron base overlaps on to the concrete base.

On the western section, Section C, no T-bars were employed at all. The flat quarter-inch ingot iron plates were bent along two edges as shown in Fig. 10. The bent-down portion is embedded in the subgrade. The

turned-up portion acts as the curb. They overlap one another, as shown by the picture. As good a bearing as was possible to get under the circumstances was given to these plates.

*Fig. 8—Placing the Third Transverse T-Bar in Section A. Men Are Standing on the First Two Placed. These Are 10 Ft. Apart. The Next Bar to Be Placed Is Resting on the Concrete Foundation*

For practical big-yardage construction a much better bedding of the plates in the subgrade should be obtained. It was believed that rolling with a heavy

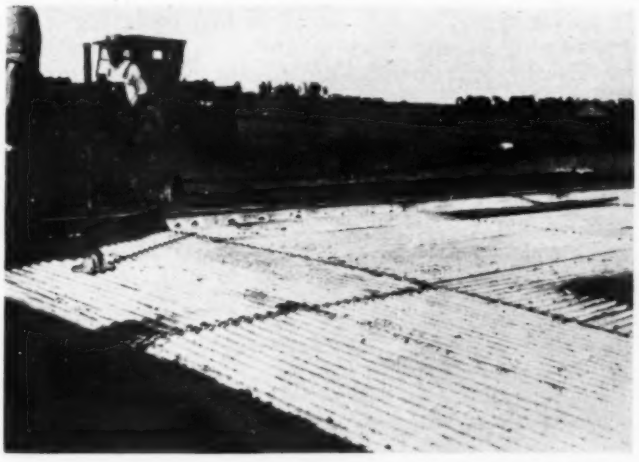

*Fig. 9—A View Showing Manner of Placing Plates in Sections A and B*

roller would have been advantageous. But since tamping was the best that could be given at the time it had to be accepted. This point will bear investigation when an inspection of the road is made in future years.

*Cushion.*—After the iron base was finished it was left to stand until the mastic cushion was applied in the regular course of events as the road was being finished. The cushion mastic was spread from off the concrete continuously over the plates and back on to the concrete section again. It consists of 90 per cent torpedo sand mixed with 10 per cent cut-back tar and is placed not to exceed 1 in. in thickness. The concrete base was finished with a smooth surface. Over the iron plates the thickness is bound to vary considerably, especially over the corrugated plates. The sand for the cushion was dried in a regular drier before the cut-back tar was mixed with it. It was then rolled ready for the 2½-in. brick which followed close behind.

*Personnel.*—Through the cooperation of the Sangamon County highway superintendent, Truman Flatt; the American Rolling Mills Co., the Poston-Springfield Brick Co., the Sangamo Construction Co., the Illinois state highway engineer, Frank Sheets; the Sangamon County board of supervisors, the National Paving Brick Manufacturers' Association, the Nitrose Co. and the Dearborn Chemical Co., it was possible for W. H. Moseley, vice-president of the Poston-Springfield Brick Co., and moving spirit of this experiment, to try out his dream of a flexible pavement. Mr. Moseley has applied for patents on this type of road.

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## Causes of Motor Vehicle Accidents

The most common causes of accidents, according to the reports of state motor vehicle bureaus, are failure of drivers and pedestrians to exercise caution at street intersections or in mid-block, passing other vehicles on curves or near the crest of hills, driving while under the influence of intoxicants or drugs, speeding on congested or winding roads, entering main thoroughfares from side roads without stopping, failure to yield right of way, and operating cars with defective mechanisms or glaring headlights.

Sudden stops on the highways, or failure to remove vehicles from the traveled portions of roads when stopped or parked, are also causes of accidents to passing vehicles.

Five of the states—Pennsylvania, Maryland and Massachusetts, New Hampshire and Vermont—have adopted laws providing for the inspection of mechanical equipment of vehicles by traffic authorities, and twelve others have passed laws requiring examination of prospective drivers, with demonstrations of ability to handle vehicles in traffic conditions, before being permitted to drive on the streets and roads.

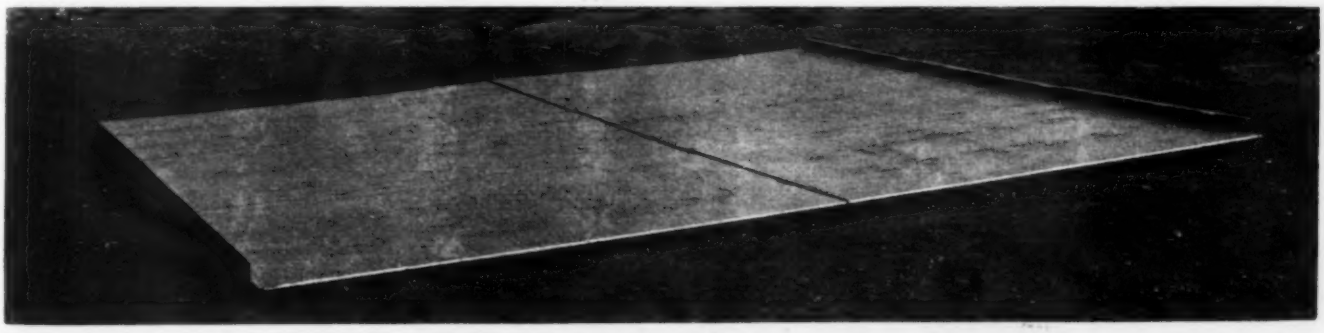
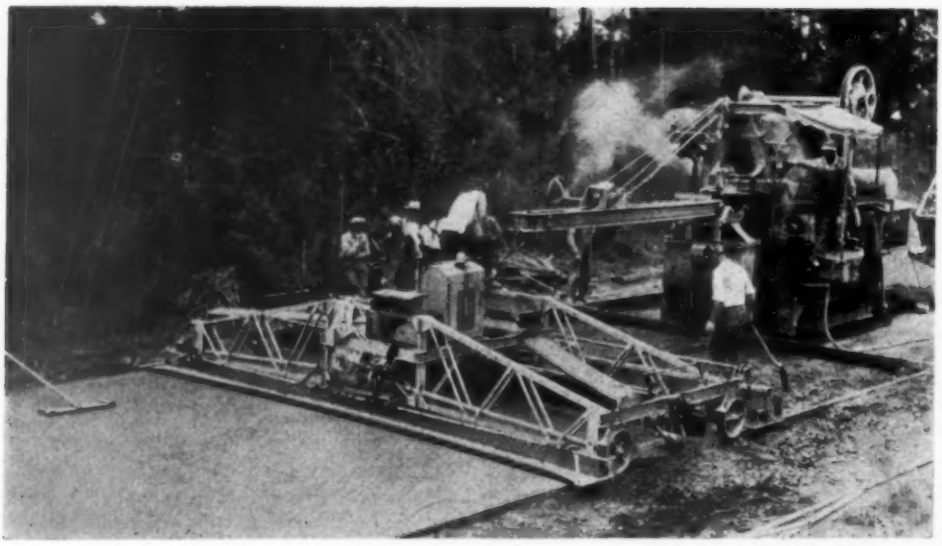


*Fig. 10—Six of the 20 Flat Plates Used on Section C Set Up in the Mill Yard to Show How They Are Used in the Road. Each Plate Overlaps the One Next to It*



*Mixing and Finishing on the State Contract*

# Paving a Pioneer Road *in Oregon*

WHEN Portland was first settled it was soon discovered that beyond the hills that encircled the city to the west there were large tracts of farming land which were more or less free from the heavy growth of timber which covered the area where Portland now stands. There was also needed an outlet to the Yamhill and Tualatin river valleys. In seeking out a route the pioneers discovered the easiest way was up the canyon of Tanner Creek. This route soon became known as the Canyon Road, which name was indelibly stamped upon it as it was the main artery used by all the immigration which flowed from Portland by land westward to the Pacific Ocean. The only other way of reaching the Oregon beaches and points along the coast in the early days was by water travel down the Willamette and Columbia rivers. This road has been rebult many times through the canyon, in the years gone by.

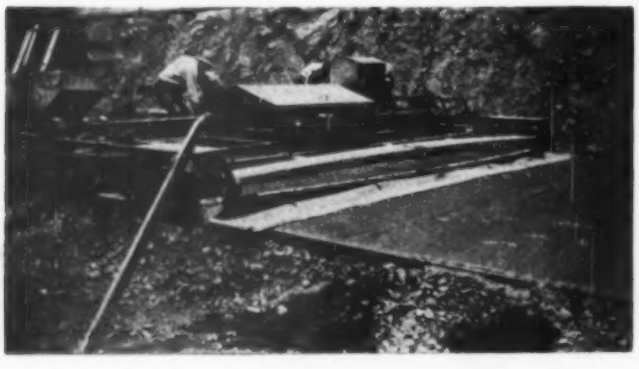
*Grading and Constructing Macadam Base Course.*—As the country west of Portland became more densely populated it was decided to improve the old road by reducing the grades, which in some cases were as high as 8 and 10 per cent, and the curvature to a modern standard. The plan adopted for this improvement had an alignment of easy curves, and a maximum grade of 5 per cent, with a roadbed 50 ft. in width. To carry out this plan the contractors, Wren & Greenough, moved some 600,000 cu. yd. of material in the 3 miles of the canyon.

Being a main thoroughfare, the heavy traffic demanded, as soon as the grading was finished, some type of surfacing. This was accomplished by laying a top dressing of basaltic rock in the form of a macadam pavement. This material ran from a 3-in. base through 1 and 1½ in. keyrocks to a finish of screenings. In some cases a light layer of clay binder was used.

Porter W. Yett, of Portland, had the contract for this surfacing and obtained the material from his Rocky Point quarries some few miles down the Willamette River. This material was barged to the Pacific Bridge Co. docks in Portland and hauled in trucks across the city to the new grade. The nature of the roadbed and the wet season combined, made it necessary to use 27,000 cu. yd. of this surfacing material in the 3-mile stretch.

For the past two years this macadam highway has been maintained with a Caterpillar motor patrol grader, assisted by a crew of county employees and much additional surfacing material from the county's quarry at Kelly Butte. A slight application of light road oil was put on once or twice each season to lay the dust.

*Contract Let for Concrete Pavement.*—Early this season the county Roadmaster, George W. Buck, and his engineers decided that sufficient settlement had taken



*Finishing on the Multnomah County Contract*

*Construction View on Multnomah County Contract*

place in the new grade and it was ready for permanent highway pavement. The contract for constructing a concrete pavement was let to I. L. Young at $181,422.97, using Oregon-made cement.

Immediately on being awarded the contract, Mr. Young's forces, under his engineer, H. E. Devereau, commenced to scarify and remove the old macadam to the proper subgrade elevation. Temporary hoppers with Johnson aggremeters were installed about midway of the work.

*Construction Operations.*—The aggregate, which is Willamette River gravel in two sizes running from 3½ to ½ in. and 1½ to ¼ in., and Columbia River sand, is hauled from the river docks by the Central Sand & Gravel Co. and is deposited in the bunkers. From these bunkers it passes through the Johnson hopper scales into the batch-divided White trucks, which carry three batches to a load, and transported to the MultiFoote paver, being dumped directly into the hopper. The Oregon-Oswego cement is added at the mixer. The mixing time is automatically arranged for an interval of one minute.

The finishing is carried on by an Ord finisher using two screeds. Immediately after the finisher moves forward and the patching-up of the edges is completed, the Hunt process of curing is applied.

The pavement, which is of two strips 18 ft. in width, is 9-7-9 or an average depth of 8 in., and is laid in 100-ft. slabs, allowing an expansion joint of 1¼ in. with contraction joints at every 20 ft. The mix is 1:2:3½, and an 8-in. core test in nine days showed 3,720 lb. The two 18-ft. strips of pavement are separated by 4 ft. of macadam.

This work is being carried out under the specifications and supervision of George W. Buck, county roadmaster; P. C. Northrup, district engineer, and Al. Mays, resident engineer. H. E. Devereau is engineer for the contractor. The Hunt process is being handled by McEverlast, Inc., under the direction of Logan Thomas, district manager.

*Paving the Adjoining Section.*—Mr. Young is also paving under a state contract this same highway beyond the Multnomah County line to Beaverton, a distance of several miles. In this operation, the aggregate comes from the Oregon City Sand & Gravel Co. and is hauled by the Southern Pacific R. R. from Oregon City to Beaverton, where it is unloaded by mechanical means into bunkers, from which it passes through the Erie batch-weighing machines to the batch-divided trucks and is hauled to the 27-E Smith paver where Santa Cruz, Calif., cement is added. The work on this section is finished by a Lakewood finisher and the curing is accomplished by covering with wet burlap and earth.

F. T. Young, representing the state highway commission, is the engineer in charge, while R. Jackson is chief inspector for the state, assisted by Al McNulty. Engineer Devereau is also in charge of this work for the contractor.

The state contract calls for a pavement 20 ft. in width with a 9-7-9-in. thickness.

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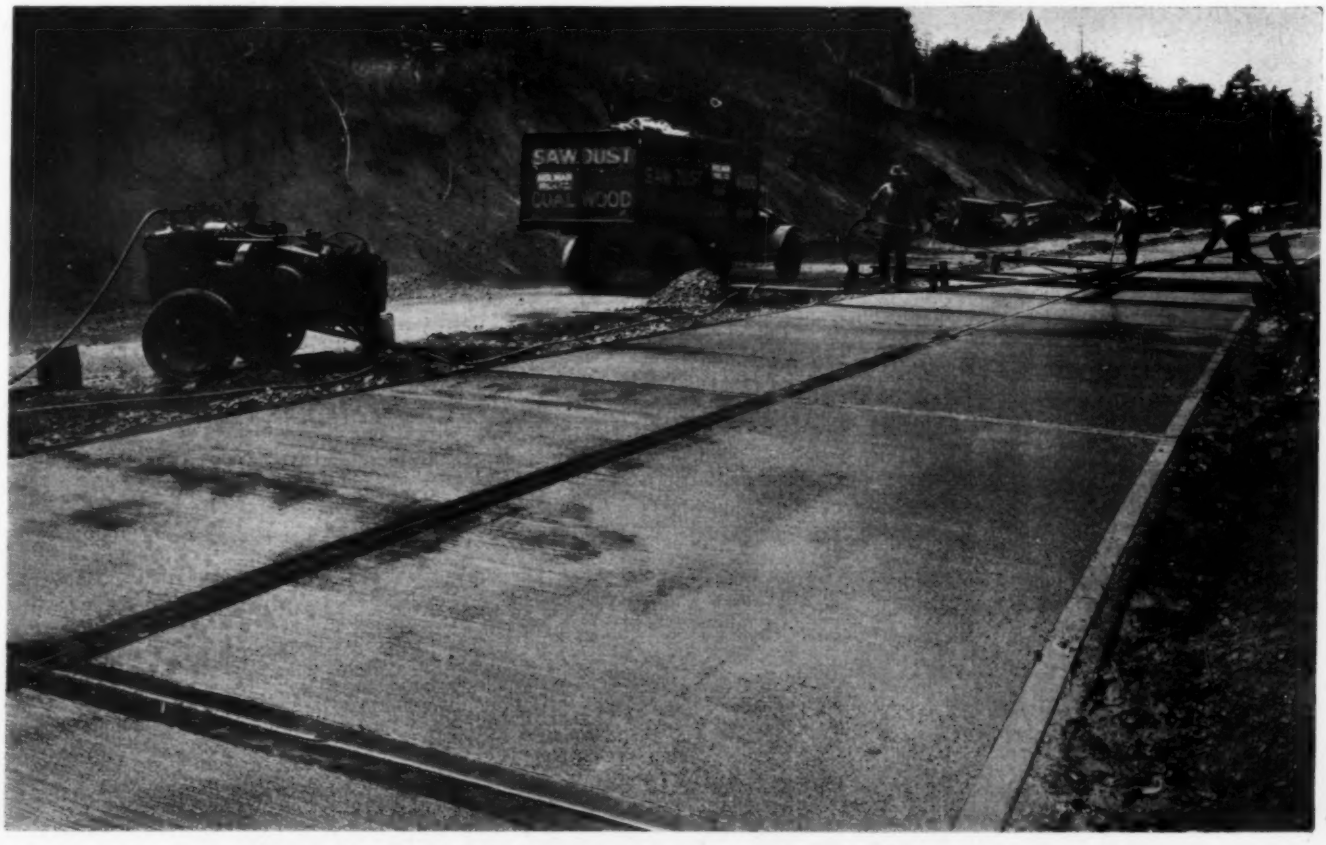
## Highway Expenditures in Canada

A recapulation from the U. S. Department of Commerce shows that the Provinces of Canada spend $70,408,934 in 1929 for road construction and maintenance, the expenditure for the latter item being $19,896,877. It is estimated that the expenditures in 1930 will total $75,184,920, of which $21,522,645 is for maintenance. For the fiscal 1931 it is estimated that $54,668,000 will be expended for construction and $24,861,780 for maintenance.




*Application of Hunt Process for Curing the Pavement*

# *Floods and the Maintenance Department*

*Pictures from* A. H. HINKLE
*Superintendent of Maintenance, Indiana State Highway Department, Indianapolis, Ind.*

Above—from ice ruts to running water on Road 41, 3 miles north of Hazelton, Ind., during 1930 flood

Left—ice and snow during 1930 flood on Road 50 at Prairie Creek bottom near Wheatland, Knox County, Ind. Pick-and-shovel crew at work

Filling calcium chloride sacks with sand to construct sand levee and prevent overflow during 1930 Indiana flood. Two dams of sand bags are laid with bags end-to-end and center core about 18 in. wide, filled with tamped sand to prevent seepage of water

# EDITORIALS

## *The Only Permanent Cure for Unemployment*

THERE is apparently many a professor of political economy who can't keep a double-entry system or interpret correctly a balance sheet. Those in that category are endeavoring to teach the most complex parts of economics before they themselves have mastered the simplest. Much the same seems to hold true as to many of the teachers of business economics. Having never served an apprenticeship as bookkeepers, nevertheless they essay to be authorities on the most abstruse principles of business economics. It is as if a man were trying to teach geodetic surveying without having ever run a line of levels, or turned a repetition angle, or taken a transit observation on Polaris.

On the other hand the country is full of business men who understand thoroughly the significance of balance-sheets and unit-cost analyses, but who have little knowledge of economic principles that relate to society as a whole. The first English writer who attempted to instruct business men in these broader economic principles was Adam Smith, famous author of "The Wealth of Nations." In that great treatise he showed that international trade is essential barter of goods for goods, and not a sale of goods for money; because if a nation attempts to sell goods only for money, and refuses to buy goods from other nations, it must eventually lose its foreign trade. It was his inference from this economic principle that a policy of "free trade," unhampered by tax barriers to protect home industries was the best policy for England to pursue. Whether this inference was entirely sound we need not discuss, our present purpose being merely to call attention to the entire soundness of the principle that international trade is essentially a barter of goods for goods. Few business men before Adam Smith's day had perceived that fact, and apparently there are many still who do not perceive it.

The present period of business depression has brought forth a vast amount of writing on the subject of business cycles; and one need not look long to find evidence that few of the writers have much knowledge of the economic forces that bring about production in excess of consumption, with resultant depression.

Ford, for example, pooh-poohs over-production of farm products as a cause of the distress of farmers. Lorimer, of the *Saturday Evening Post,* urges further curtailment of immigration as a means of reducing unemployment. And so on. Having operated in a field where the demand for his product has been limited only by the buyer's purse, Ford shows little understanding of conditions in a field where the demand is limited by the size of the buyer's stomach. Taught by the books on economics, Lorimer still labors under the delusion that adding to population increases the demand for jobs beyond the ability of employers to supply jobs. This is the same delusion that has obsessed the labor unions in every country from time immemorial. In India it led to the caste system, under which one must be born the son of a porter if he is to be permitted to "port."

A comprehensive study of the subject of over-production discloses two outstanding principles: (1) That those industries that suffer most are the ones in which demand for their product is least flexible; (2) That those owners and companies suffer least that expand their plant capacity but slowly in the fields where demand is less flexible, making their greatest expansions in fields where it is more flexible.

The du Ponts, General Motors, A. T. and T. and many other highly successful organizations have avowedly adopted the policy of catering to what may be termed latent demand. The telephone, for example, is a device that every one wanted but that few possessed 20 years ago. The same was true of the motor car. When the saturation point for telephones came into view, we saw that great subsidiary of the A. T. and T., the Western Electric Co., conducting researches that culminated in the talking picture. When the demand for motor cars began to show signs of lagging, we saw General Motors launch its electric refrigerators, and later we heard them announce, as a policy, their intention of manufacturing anything for which the future demand seemed likely to be strong. The du Pont exhibit at the Chemical Exhibition shortly after the war was an amazing revelation of the versatility of a firm whose product had previously been little else than explosives.

Imagine the du Ponts acting on the principle involved in Ford's advice to farmers! Explosives would have continued to pour forth during times of peace as during times of war. The du Ponts would have gone broke and their thousands of employes would have been discharged.

The greatest business leaders of the future are likely to be those who most accurately determine what products or services the public is most likely to buy with avidity, provided the goods or services can be produced at prices within the purse of the average consumer. Ford has it to his everlasting credit that he correctly analyzed the possibilities of automobile sales, and set himself to devise ways of producing a serviceable car at a very low but profitable price. He became a great human benefactor by his display of business acumen, scientific inventiveness and persisting energy. It is strange that we now find him telling farmers to go on glutting a glutted market, for that was precisely what Ford did not do himself. On the contrary, he says in his books and articles that he sensed the latent demand for motor cars, and perceived that in this new field of manufacturing all that then stood in the way of enormous expansion was the high price of cars. Note particularly his sensing of a great latent demand.

In the providing of paved highways for motor cars and trucks, there is another and as yet but partly exploited field. Fortunately some legislator finally hit upon a simple and effective way of raising money for highway improvement, namely the gasoline tax. So if no unwise legislation curtails this source of revenue, thousands upon thousands of new jobs will be created annually by the expansion of the industry, of building and maintaining highways. A monument should be erected to the state legislator who introduced the first gasoline tax bill and another monument should rise in honor of the inventor of the internal-combustion engine.

Scientific research, invention, good legislation and business acumen form the "big four" upon which the solution of the unemployment problem depends. Our present plea is for a great display of business acumen in discovering and developing those latent human demands that will furnish continuous employment at increasing wages.

## *Why Railway Commissions Should Not Control Highway Transportation*

MANY a medicine is diluted poison. Taken in small doses the poison is curative; in large doses it is lethal. Competition is this sort of a poison-medicine. We find its deadly qualities emphasized by the socialists; its healthful qualities, by the capitalists. Yet nearly every practicising capitalist is quick to embrace methods by which competition can be reduced. While subscribing to the maxim that "competition is the life of trade," he is opposed to "cut-throat competition."

One of the greatest of economic problems is how to control competition without entirely destroying it. Our English contemporary, "Roads and Road Construction," points out that British railways have been stoutly opposing highway transportation, and that their opposition has been effective. In brief, British railway companies are now trying to prevent competition from motor-buses, in just the same way that stage-coach owners fought the early railways in England.

Great Britain is not the only transportation battlefield. We have not a little of the same sort of warfare in America, and it has reached the stage where legislators are being importuned to curb the owners of motor-buses and motor-trucks by placing them under the jurisdiction of railway and public service commissions. Doubtless many a railway company is supporting this plan, for it offers a practical way of reducing competition. If a highway transport company is controlled by the same public service commission that controls the railways, it is reasoned that motor-buses and motor-trucks will be considerably repressed in their efforts to secure business now enjoyed by railways.

Had the policy of extensive government control of railways been as successful as was hoped when initiated a generation ago, we might look forward with equanimity to an application of similar control to our highway transport companies. As it is we regard such a prospect with dismay. No great industrial tool in America has improved so little in the past 25 years as the tool that we call the railway. If government control has not reduced railway progress, what has been the cause? When we contrast the very slight changes in the mechanism of railway facilities with the enormous changes in automobiles we are led to ask the reason. The first answer that is apt to come to the lips is that progress is always more rapid in a new industry than in an old one. Granting this to be so, again we ask why? Is it because mechanism is so closely akin to animalism? Do machines have their infancy, their adolescence and their senility? Yes, but primarily because of obsolescence. Obsolescence results entirely because inventive minds have worked effectively. Hence the senility that most machines suffer is primarily that that results from invention. Our locomotives are not suffering from that sort of senility, whereas our automobiles are. American railway locomotives have a life that averages 20 years, or more, whereas automobiles live about one-third of 20 years, and then die because automobiles have been so greatly improved in 7 years as to make owners eager to scrap "the old boats."

Henry Ford bought a railway many years ago, and tried to apply to it the same industrial methods that he has used so successfully as a manufacturer of motor vehicles. In his book he tells some of the results. He succeeded in greatly reducing costs per ton-mile, but when he tried to reduce freight rates the Interstate Commerce Commission called a halt. That would upset the "rate structure" of all the railways in nearby states. What could be more dreadful? So Ford closes his chapter on railways with a few pithy expressions of disgust. It is our recollection that he has sold his railway.

When you stop to think of it, why should any railway executive strive to lower his operating expenses to a point that will yield more than about 6 per cent on the value of his railway? Under the law the government would be entitled to half of the excess profit, and could, if it cared to do so (and it usually cares to do so) reduce railway rates until they yield no more than 6 per cent. So the greatest incentive to improve railways is absent in America, and we are witnesses of the results.

A generation ago it was confidently predicted by competent electrical engineers that within a decade our main railways would be electrified. Why has that prediction failed so dismally? The answer seems to be that under our present system of public control of railway rates, the owners of railways could hope for no greater profit as the result of electrification.

We have diluted the poison of railway competition until it is not only innocuous but ineffective as a stimulus.

It is a survey and no hasty one either—of the results of public control of railways that leads us to doubt the wisdom of placing highway transport organizations under the control of railway commissions. Far better would it be to place them under the control of state highway commissions. Then by letting these two systems of transportation (railways and highways) fight for traffic, it may be possible to put enough tonic into the railways to cause them to progress in a manner comparable with the progress of the motor vehicle industry.

## *Why the Size of Motor Vehicles Should Not Be Limited*

HAD it been as easy to widen railways as it has been to widen highways, railway rolling stock would be quite different from what it is. On account of the flexibility of the highway as to width, there should be no legislation limiting the width of motor vehicles. There is even less reason for limiting the length of such a vehicle as Ohio has recently decided to do. Vehicles longer than 30 ft. are prohibited on Ohio roads.

A wide vehicle may make it difficult for other vehicles to pass, but the proper remedy is not legislation. It is road widening. A long vehicle may be obstructive on sharp curves, but again the remedy is road improvement and not legislation. Sharp curves should be eliminated.

The history of American railway progress has been largely a history of reconstruction. Light rails have been replaced by heavier rails, and those in turn by still heavier rails. A few years ago the editor estimated that under the average traffic in America a rail would last a century, if wear and tear were the sole cause of depreciation. Actually the life had averaged about 20 years. The reason for so short a life was the increasing wheel-loads. The life of the average locomotive was also about 20 years. This made clear the reason for an equal economic life of the rails, for locomotives are usually scrapped because they are too light to carry the increasing traffic economically.

Properly studied this part of the history of railway development becomes very useful in planning highway

improvement, for motor-vehicles are showing the very same tendency to increase in size and weight. Had legislation hampered American railway progress by limiting the size of locomotives and cars, our rolling stock probably would be as absurdly small here as it is in Europe.

W. P. Gillette

## What's the Address?

"ABOUT a mile ahead take the right hand branch of the Y and follow the main traveled road till you come to a school and church, then turn left two miles till you come to a white house with a red barn at the fork of the road, go about 3 miles and follow the left branch of the gravel road—etc." How many times have such directions been given to travelers on the county and township road systems who have had the temerity to leave the beaten path without a guide. As a convenience to travelers the naming and numbering of all roads would be warmly welcomed. Long distance travelers are relatively immune from this sort of confusion because of the standardized numbering systems adopted on main highway routes by the federal and state governments. However, there are times when everyone has need to leave the beaten path. At these times they run the risk of aimless wandering as many of us have done many times.

Consider the difficulty a sheriff or a doctor has in locating a place in a hurry. Very often he is called to the scene of an accident somewhere in the country and must stop to ask numberless questions to get the correct location of the accident. In such emergencies the loss of two or three minutes' time may mean the loss of a life that could have been saved. If for no other reason than to facilitate the dispatch of officers the roads and houses should be named and numbered as city streets are.

It is well known the way houses are strung along a highway in suburban communities. An officer desiring to find one of those houses in the night certainly loses time and patience in his hunt for the right place. If a county had adopted a numbering system on named roads the house desired could be readily reached.

Surely it should not be impossible to devise a system of identification of place such that a stranger could find the place by the address on a letter. In the days before the automobile, every farmer knew every other farmer in his neighborhood. There was no need for identification of place. However, the automobile has changed that. It has taken the farmer far from his home surroundings to strange places. It has taken the city man to the country. Either, desiring to record the place of an event, would find it difficult to do. It would be still more difficult to find the place again under conditions as they are now.

Certainly the added convenience of an identifying system would justify the expenditure required. A coordinated investigation of this problem by the Rural Letter Carriers, and others, sponsored by the County Highway Officials Division of the American Road Builders' Association would bring forth ideas from which a uniform rural numbering system or system of addresses could be evolved.

V. Prosser

## Administering State Gas Taxes on County Highways

ALL states and counties are interested in the receipts and disbursements of gasoline taxes. Counties are clamoring for their share of these taxes. There is general agreement that counties should receive their share, but what this amount should be and how, when and where it should be expended are puzzles to many competent officials.

The direct and definite procedure in Illinois, as explained by Frank T. Sheets, Chief Engineer, Illinois Division of Highways, is one solution which appears workable. Briefly stated, the Illinois State Highway Department will have general supervision of road and bridge work done by counties with gas tax money. The fund for this work is one-third of the proceeds of the state tax of 3 ct. per gallon on motor fuel. Following are some of the high spots of the general plan:

1.—The general policies on types of construction range from simple earth grading or isolated bridges and culverts to the highest type of pavement.

2.—The standard specifications for the state highways have been revised to include many low cost types of construction which are suitable for light traffic roads, and which utilize local materials. The types of surfacing included are oiled earth roads, sand-clay, traffic bound gravel and crushed stone, the best types of bituminous surface treatments, bituminous penetration macadam, bituminous concrete, portland cement concrete and brick.

3.—Where local materials are suitable, they will be used, and the Illinois Geological Survey is engaged in a detailed survey of material deposits throughout the state.

4.—The selection of type of surfacing will be based on studies of the population, industries, and probable growth of both. With this and other data available, a forecast will be made of the probable number of horse-drawn vehicles, passenger cars and heavy trucks, for each project and from this the selection of an adequate type of surfacing will be made.

5.—In general a width of 30 ft. from shoulder to shoulder is recommended, but in rough country and under special conditions 24 ft. will be approved.

6.—The alignment and grades will be such as to provide safety in travel but on the less important roads short stretches of nine per cent grades will be permitted.

7.—In the preparation of road plans, the same degree of refinement as on state roads, will not be required; but for the higher type pavements practically the same accuracy will be necessary.

8.—In order to extend to counties the maximum of consulting service and in order to bring to bear on the county road problem the thought of a corps of expert engineers, there has been created in the Illinois Division of Highways, a Bureau of County Roads.

The plan is well conceived and a study of the details clearly shows that an honest and effective effort is being made to improve the county roads of Illinois.

What that state is doing can be done by others in recognizing that all the roads belong to all the people, and that state and county must work together to solve the secondary road problem.

T. H. Rumer

# *Sixth International Road Congress*

Outstanding highway engineers and administrators of practically every country in the world will assemble at the Sixth International Road Congress which is to be held October 6 to 11, at Washington, D. C. The congress will take place under the auspices of the American Organizing Commission of the Permanent International Association of Road Congresses. The latter was organized in Paris in 1908 and has a present membership of about 2,000. At the time of its organization its primary purpose was to study "the improvement of roads in view of their use by new forms of locomotion; this referring particularly to the advent of the high-speed motor-vehicle traffic, the effects of which on the old type roads were just then becoming apparent. Since that time the scope of the association has been enlarged and its primary function now is to act as a clearing house for the distribution of the results of research and practices bearing upon old phases of highway development and usage.

The first International Road Congress was held in Paris in 1908, with an attendance of 1,100; 28 governments were represented by the second congress at Brussels, 35 governments sent delegates, and the attendance was 1,200. The third congress was held in London in 1913, 44 governments being represented and the attendance being over 2,000. Owing to the war and the resulting international ill feeling prevailing for some years thereafter, the next congress was not held until 1923. This convened at Seville, Spain; 45 governments were represented and the attendance was about 1,000. The fifth congress was held in Milan with an attendance of approximately 1,800, and 55 governments sending delegates. At the coming congress it is expected around 60 countries will send official delegates and in addition some 2,000 delegates will be present from the United States.

*Agenda of the Congress.*—The program was arranged by the American Organizing Commission, of which Roy D. Chapin is president and Thos. H. MacDonald, secretary-general, to comply with the requirements of the agenda prepared by the Permanent International Commission of the Permanent International Association of Road Congresses. The agenda follows:

FIRST SECTION

CONSTRUCTION AND MAINTENANCE

*First question.* Results obtained by the use of:

(a) Cement;
(b) Bricks or other artificial paving. (Methods employed for road construction and maintenance in these materials.)

*Second question.* The most recent methods adopted for the use of tar, bitumen, and asphalt in road construction.

*Third question.* The construction of roads in new countries, such as colonies and undeveloped regions.

SECOND SECTION

TRAFFIC AND ADMINISTRATION

*Fourth question.* Ways and means of financing highways:

(a) Road construction;
(b) Maintenance.

*Fifth question.* Highway transport: Correlation and coordination with other methods of transport; adaptation to collective (organizations) and individual uses.

*Sixth question.* 1. Traffic regulation in large cities and their suburbs; traffic signals; design and layout of roads and adaptation to traffic requirements in built-up areas.

2. Parking and garaging of vehicles.

A total of 76 reports has been prepared on the above subjects and these will be discussed at the congress.

*Road Machinery and Materials Exhibition.* — Simultaneously with the congress an international exposition and demonstration of road machinery and materials will be held under the auspices of the American Road Builders' Association. The exposition will include an exhibit of road building and maintenance materials and equipment, among which will be found excavators, power shovels, backfillers, truck bodies, carts, compressors, cranes, crushers, distributors, engines, street flushers, forms, fresnos, graders, kettles, mixers, motors, pavers, pumps, reinforcement, rollers, scarifiers, screens, traffic signals, spreaders, subgrade machines, tanks, tractors, trailers, trucks, asphalts, emulsions, tars, cements, steel and other equipment and materials used in road and street construction and maintenance.

On the demonstration field the construction and maintenance equipment will be shown in actual use. These demonstrations will be varied each day in order that various types of construction and maintenance may be made available for the inspection of the visiting delegates.

*Program of Congress and Exposition.*—The program is as follows:

*Sunday, Oct. 5*

4:00 p. m. to 6:00 p. m.—Reception in honor of Honorary Representatives of the American Road Builders' Association, offices of the American Road Builders' Association, Suite 938, National Press Building.

*Monday, Oct. 6*

10:00 a. m.—Meeting, Permanent International Committee; Chamber of Commerce.

2:00 p. m.—Opening plenary session; Constitution Hall.

5:00 p. m. to 7:00 p. m.—Reception in honor of all visiting delegates; Offices of the American Road Builders' Association, Suite 938, National Press Building.

Evening—Suppers and entertainments by unofficial bodies; Embassies.

*Tuesday, Oct. 7*

9:00 a. m.—First section meetings; Chamber of Commerce.

12:30 p. m.—Luncheon tendered by American Road Builders' Association; Washington Auditorium.

1:30 p. m.—Opening of International Exposition and Demonstration; Washington Auditorium and Demonstration Field. (The exposition will be open during the evening.)

*Wednesday, Oct. 8*

9:00 a. m.—International Exposition and Demonstration; Washington Auditorium and Demonstration Field. Second section meetings, Chamber of Commerce.

12:30 p. m.—Luncheon tendered by the American Automobile Association; Willard Hotel

2:00 p. m.—Third section meetings; Chamber of Commerce.

*Thursday, Oct. 9*

9:00 a. m.—International Exposition and Demonstration; Washington Auditorium and Demonstration Field. Fourth section meetings; Chamber of Commerce.

1:00 p. m.—Inspection Mt. Vernon Memorial Highway and Mt. Vernon; Mt. Vernon.

8:00 p. m.—Dinner tendered by American Organizing Committee; Willard Hotel.

*Friday, Oct. 10*

9:00 a. m.—International Exposition and Demonstration; Washington Auditorium and Demonstration Field. Plenary session for passing upon conclusions; Chamber of Commerce.

2:00 p. m.—Excursion; Arlington Experimental Station.

8:00 p. m.—Closing plenary session; Chamber of Commerce.

10:00 p. m.—Reception by the Secretary of State; Pan-American Union.

*Saturday, Oct. 11*

10:00 a. m.—Inspection of United States Naval Academy; Annapolis, Md.

12:30 p. m.—Reception by Governor Ritchie; State House, Annapolis, Md.

1:30 p. m.—Luncheon by Governor Ritchie; Annapolis Roads Club, Annapolis, Md.

*NOTE—There will be motion picture showings at 8:30 a. m. preceding the morning section meetings and immediately following the afternoon section meetings.*

*Every afternoon at 5 o'clock there will be special demonstrations at the Demonstration Field.*

*Exhibitors at Exposition.*—The exhibitors at the exposition and demonstration of road construction and maintenance equipment and materials include the following:

J. D. Adams Co.
Allis-Chalmers Manufacturing Co.
*The American City Magazine.*
American Gas Accumulator Co.
American Tar Products Co.
Armco Culvert Manufacturers' Asso.
Arundel Corp.
Asphalt Institute.
Austin Manufacturing Co.
Automatic Signal Corp.
Barber Asphalt Co.
Barrett Co.
Bay City Shovels, Inc.
Biehl Iron Works, Inc.
Black & Decker Mfg. Co.
Blaw-Knox Co.
Bragg-Kliesrath Corporation.
Bucyrus-Erie Co.
Byers Machine Co.
Caterpillar Tractor Co.
Centaur Tractor Corp.
Central Iron & Steel Co.
Clay Products Association.
Clinton Motors Corp.
Colprovia Roads, Inc.
Conant Machinery and Steel Co.
Concrete Surfacing Machinery Co.
*Contractors & Engineers Monthly.*
*Engineering News Record.*
Euclid Crane & Hoist Co.
Flintkote Co.
Ford Motor Co.
Galion Iron Works & Mfg. Co.
*Gillette Publishing Co.*
W. S. Godwin Co., Inc.
Good Roads Machinery Co.
W. & L. E. Gurley.
Hamilton Mfg. Co.
Harnischfeger Sales Corporation.
Hastings Pavement Co.
Heil Co.
Heltzel Steel Form & Iron Co.
Hercules Motors Corp.
Highway Service, Inc.
Charles Hvass & Co., Inc.
International Bitumon Emulsions Corp.
Irving Iron Works Co.
Keuffel & Esser Co.
Kinney Mfg. Co.
Kohler Co.
Lakewood Engineering Co.
McEverlast, Inc.
Alexander Milburn Co.
Motor Improvements, Inc.
National Equipment Corp.
National Highway Association.
National Paving Brick Mfg. Asso.
Norma-Hoffman Bearings Corp.
Northwest Engineering Company.
Tinius Olsen Testing Machine Co.
Pan American Petroleum & Transit Co.
Portland Cement Association.
Ransome Concrete Machinery Co.
Reo Motor Co.
W. A. Riddell Co.
Sawyer-Massey, Ltd.
Shell Petroleum Corp.
Southwark Foundry & Machine Co.
Standard Oil Co. of New Jersey.
Standard Oil Co. of New York.
Stroud Road Machinery Co.
The Texas Co.
Transit-Mixers, Inc.
Truscon Steel Co.
United States Steel Products Co.
Walter Motor Truck Co., Inc.
Warren Bros.
Waukesha Motor Co.
WEJ-Lock Mfg. Co.
Welsbach Traffic Signal Co.
The White Co.

# How States Buy Road Equipment

*By* D. R. LAMSON

*Assistant Engineer, American Road Builders' Association*

Information about the official recommending purchase of material and equipment and who signs the order has been obtained in an equipment study made by the American Road Builders' Association—this information being obtained through searching questionnaires that covered the whole field of purchasing in the 48 states.

In general, equipment and material are recommended by the field forces, usually district or division engineers, and purchases are made through the central office.

The practice followed in each state is given in detail in Table I.

Construction is directed in all cases by the various states. Maintenance is directed by the state in all but three states in which county and states join in the maintenance of state highways. Construction is by contract in all but three states; in Oklahoma state forces are employed, in Vermont both contract and state forces are used, in Virginia both contract and convict labor methods are in vogue. State forces are not employed in seventeen states on construction; in the remainder of the states state forces are used under varying conditions. Tabulation follows:

| State | State Use of Own Forces |
|---|---|
| Alabama | Emergency |
| Arizona | None |
| Arkansas | None |
| California | Very little |
| Colorado | 10% with county forces |
| Connecticut | Very little |
| Delaware | None |
| Florida | Convict force |
| Georgia | Very little |
| Idaho | Emergency |
| Illinois | When bids are too high |
| Indiana | None |
| Iowa | None |
| Kansas | Part of maintenance |
| Kentucky | State forces, 10% |
| Maine | Some day labor |
| Maryland | None |
| Massachusetts | Prison labor |
| Michigan | None |
| Minnesota | None |
| Mississippi | Emergency |
| Missouri | When bids are too high |
| Montana | None |
| Nebraska | None |
| Nevada | Some small projects |
| New Jersey | Very little |
| New Mexico | None |
| New York | 10% |
| North Carolina | None |
| North Dakota | None |
| Ohio | State forces |
| Oklahoma | Very little |
| Oregon | Some work by state forces |
| Pennsylvania | None |
| Rhode Island | Very little |
| South Carolina | None |
| South Dakota | Less than 10% |
| Tennessee | None |
| Texas | Very little |
| Utah | Contract and state forces |
| Vermont | Contract and convict labor |
| Virginia | Very little |
| Washington | Few small projects |
| West Virginia | Some by county forces |
| Wisconsin | Very little |

TABLE I

| State | What Official Recommends Equipment to be Purchased | Who Gives Order for Purchase. |
|---|---|---|
| Alabama | Division using equipment | Purchasing Agent |
| Arizona | District Engineers | Equipment Engineer |
| Arkansas | District Engineers | Equipment Engineer |
| California | Equipment Engineer | State Purchasing Agent |
| Colorado | Supt. of Maintenance Asst. Engineer | State Highway Engineer |
| Connecticut | State Highway Commissioner | State Highway Commissioner |
| Delaware | Chief Engineer | Chief Engineer |
| Florida | Chief Engineer | Chairman of Commission |
| Georgia | State Highway Engineer Maintenance Engineer | Purchasing Agent |
| Idaho | Equipment Engineer | Commissioner of Public Works |
| Illinois | Bureau Heads | State Purchasing Agent |
| Indiana | Chief of Divisions Construction Maintenance | Director Highway Commission |
| Iowa | Maintenance Engineer | State Highway Engineer |
| Kansas | Division Engineers Department Head | Director |
| Kentucky | State Highway Engineer | State Purchasing Commission |
| Maine | Head of Divisions | Commission |
| Maryland | Chief Engineer | Purchasing Agent |
| Massachusetts | Maintenance Engineer | Purchasing Bureau |
| Michigan | Maintenance Engineer Construction Engineer | Materials Engineer |
| Minnesota | Construction, Off. Engineer Maintenance, Maintenance Engineer | Engineer in Charge of Equipment |
| Mississippi | District Engineers | State Highway Commissioner |
| Missouri | Maintenance Engineer | Superintendent of Equipment |
| Montana | State Highway Engineer | Purchasing Agent |
| Nebraska | State Highway Engineer | Purchasing Agent |
| Nevada | Assistant Highway Engineer Superintendent of Equipment | State Highway Engineer |
| New Hampshire | Division Engineers Garage Superintendent | Purchasing Agent |
| New Jersey | Superintendent of Plant and Equipment | Purchasing Agent |
| New Mexico | State Highway Engineer | State Highway Engineer Equipment Engineer District Engin |
| New York | District Engineers | Commissioner of Highways |
| North Carolina | State Highway Engineer Chief Engineer | Chairman of Commission Chief Engineer |
| Ohio | Division Engineers Purchasing Agent Chief of Maintenance | Division Engineers Purchasing Agent Chief of Maintenance |
| Oklahoma | Division Engineers | Division Engineers approved by S. H. C. |
| Oregon | Equipment Engineer | Equipment Engineer |
| Pennsylvania | Equipment Engineer | Chief Engineer approved by Secretary of Highways |
| Rhode Island | Supt. Mechanical Equipment Chief Engineer Commissioners | Superintendent of Mechanical Equipment |
| South Carolina | Maintenance Engineer State Highway Engineer | Superintendent of Pur. or Highway Commissioner |
| South Dakota | Maintenance Engineer | Department of Purchase and Finance |
| Tennessee | Maintenance Engineer | Purchasing Department |
| Texas | State Highway Engineer | State Board of Control |
| Utah | Chief Engineer | State Highway Commissioner |
| Vermont | Commissioner of Highways | Purchasing Agent |
| Virginia | Equipment Engineer | Chief Engineer to Pur. Agent |
| Washington | District Engineers | Supervisor of Purchasing |
| West Virginia | Division Engineers | Purchasing Agent |
| Wisconsin | Counties Purchase thru Committees | |
| Wyoming | District Engineers Equipment Engineer | Approved by Superintendent of Equipment |

# *Ninth Annual Asphalt Paving Conference*

Salvaging of old macadam and gravel roads and the building of farm-to-market roads as a measure of farm relief, as an aid to unemployment, as a means of increasing the amount of freight handled by the railroads of the country and as affording relief for traffic congestion on main highways, will be the keynote of the Ninth Annual Asphalt Paving Conference to be held at the Hotel Peabody in Memphis, Tenn., December 1 to 5, 1930. The conference, as usual, will be under the auspices of The Asphalt Institute, J. E. Pennybacker, managing director, and the Association of Asphalt Paving Technologists, C. A. Mullen, secretary.

Among the speakers expected to discuss the matter of improving farm-to-market roads with low cost surfaces are: Sam H. Thompson of Chicago, president of the American Farm Bureau Federation; Ernest H. Smith, executive vice-president of the American Automobile Association, Washington, D. C., and R. H. Aishton, New York and Washington, chairman, American Association of Railway Executives, and president, American Railway Association. Mr. Aishton's particular subject will be: "Co-ordinating Rail, Water and Highway Transport."

The program for this year's conference has been altered somewhat radically, the various technical subjects to be considered, being laid before the conference in the form of reports by technical committees appointed to make the necessary surveys. Discussion of the reports will follow, orally and in written form.

These committees are as follows:

*Committee on Resurfacing.*—Frank L. Raschig, first assistant director, State Department of Highways, Columbus, O., chairman; Clarence Proctor, consulting engineer, Michigan Laboratories, Inc., Detroit, Mich., and Jacob L. Bauer, state highway engineer, New Jersey Highway Commission, Trenton, New Jersey.

*Committee on Maintenance.*—Maj. F. M. Davison, engineer of maintenance, District of Columbia Highway Department, Washington, D. C., chairman; C. E. Myers, director of City Transit, Philadelphia, Pa.; J. B. Early, maintenance engineer, Texas Highway Department, Austin, Tex., and W. E. Duckett, Hennepin county highway engineer, Minneapolis, Minn.

*Committee on Widening of Pavements.*—B. E. Gray, highway engineer, The Asphalt Institute, New York, N. Y., chairman; Charles S. Pope, chief construction engineer, California Division of Highways, Sacramento, Calif., and Daniel Soule, maintenance engineer, Rhode Island Board of Public Roads, Providence, R. I.

*Committee on Airport Surfacing.*—W. N. Carey, chief engineer, Department of Public Works, St. Paul, Minn., chairman; P. J. Freeman, chief engineer, Bureau of Tests and Specifications, Alleghany County Department of Public Works, Pittsburgh, Pa.; Mark R. Thompson, engineer in charge of bituminous pavements, Board of Public Service, St. Louis, Mo., and Col. R. Keith Compton, director of public works, Richmond, Va.

*Committee on Stage Construction.*—Charles E. Grubb, engineer-director, County Highway Officials' Division, American Road Builders' Association, Washington, D. C., chairman; T. C. McEwen, state highway engineer, Tennessee Highway Department, Nashville, Tenn.; B. P. McWhorter, state highway engineer, Highway Board of Georgia, East Point, Ga.; F. H. Shepherd, engineer of maintenance, Queensboro Bureau of Highways, New York, N. Y., and C. S. Christian, chief engineer, Arkansas Highway Commission, Little Rock, Ark.

Among the speakers will be Leroy M. Law, president, The Asphalt Institute; Prevost Hubbard, president, Association of Asphalt Paving Technologists; Mayor Watkins Overton and City Engineer, W. B. Fowler of Memphis; R. H. Baker, State Highway Commissioner of Tennessee; Horner P. Keith, chief maintenance engineer of Alberta Province, Canada, who will discuss "Canada's Experience in Solving Local Road Problems"; J. J. Forrer, state maintenance engineer of Virginia, who will speak on "The Development of a State Highway System"; E. F. Kelly, chief of research, U. S. Bureau of Public Roads, Washington, D. C., whose subject will be "Simplified Specifications for Asphaltic Materials"; Roy W. Green, president, Western Paving Laboratories, Lincoln, Nebr., who will discuss "Economic Thickness of Foundation and Wearing Course"; J. T. Pauls, senior highway engineer, U. S. Bureau of Public Roads, Washington, D. C., who will talk on "The Mixed-in-Place Method"; H. C. Weathers, testing engineer of the Florida Road Department; H. J. Spelman, chief engineer of the West Virginia Road Commission; C. S. Mullen of Montreal, Quebec, Canada, and Clarence D. Pollock, a consulting engineer of New York, all of whom will discuss the use of asphaltic materials for "mat" or "carpet" coats, mixed-in-place construction, cold-mix road types and joint and crack fillers, respectively. W. E. Hawkins, construction engineer of the North Carolina Highway Department and R. W. Coburn, construction engineer for the Massachusetts Department of Public Works, are expected to discuss sand-asphalt pavement construction.

Airport paving, too, will receive considerable attention on the program with a thorough discussion of the airport committee's survey of practice in asphalt runway paving and landing field treatment at numerous airports throughout the country. One entire session will be devoted to this subject, a session on asphalt technology will be held under the supervision of the Association of Asphalt Paving Technologists, the program for which will be prepared by the latter organization.

Several new and novel entertainment features will be provided during the week for the men and women in attendance. These will include a dinner-dance with an especially staged cotton plantation dancing and singing act; a supper-dance with a novel miniature race track feature; an automobile trip through Memphis and its environs; a golf tournament, a special bridge-tea for the ladies and an evening entertainment at one of the leading Memphis night clubs. All railroads in the United States and Canada have granted a reduced rate of one and one-half fare for the round trip to those who attend the conference. Local arrangements at Memphis are in the hands of a committee headed by W. B. Fowler, Memphis city engineer.

# County and Township Roads

*A Section Devoted to the Interests of Those Responsible for Secondary Road Improvement*

# *Practical State Aid for Strictly Local Roads*

*By* JOE L. LONG
*Associate Editor*

HIGHWAYS of such character and location as to become main routes of travel from one large section of our country to another, become associated in the minds of the public with other national undertakings such as waterways, air-mail routes, etc.

Trunk lines connecting county seats and continuously uniform across a state are recognized and called state roads, regardless of governmental control, and the main routes of concentrated local market travel are, throughout most of our states, usually a part of the county roads.

For the first class, no one would designate more than 5 per cent; probably 2 to 3 per cent of our 3,000,000 miles of public roads would ordinarily be included by those who would be in a position to outline such a system. For state roads 10 per cent on an average would meet all present developments and contemplated additions. In the middle west, which might well represent the average conditions, 20 to 25 per cent would probably be classified as county roads or eligible for this development as arteries of local marketing.

*Large Mileage of Local Roads.*—There would most certainly remain 60 to 70 per cent of our mileage that would be of interest only to those living alongside or within a mile or two of the so-called roads. This common interest would apply only to very short sections, 5 miles being almost the limit, and 1 to 3 miles comprising the great bulk of stretches in which a compact group of farmers would be equally or definitely united by their need for such a road to connect with the county roads and thus with the entire main system of transportation.

Fully one-half the farm homes of our most productive sections are situated on roads that can by no stretch of the imagination be considered main arteries of even local travel, yet there is a very definite public interest in these roads, along which is produced about one-half of the food that our people consume. No reasonable person will question the statement that every citizen of Chicago or New York is financially interested in transportation costs between his dining table and the field or garden where his food is grown; and the farmer is likewise interested in the transportation costs of his machinery, his clothing and the various foods that he purchases other than those produced on his farm.

Anything and everything that interferes with, hinders or adds to the time and effort consumed in making these exchanges must be added eventually to what we pay. Perhaps it would be better appreciated if we say that all of these uncertainties, such as interruption of traffic because of weather, and other difficulties, subtract their quota from what we get for our money.

*The Special District.*—It would seem that no political unit, nation, state, county, parish, town or township can possibly fit the purely local conditions that apply to these individual stretches. The special district formed for the improvement of certain specified roads offers the most practical basis at least for initiating the improvement; the work would be supervised, of course, by competent county authorities.

But the farmers on these roads pay the same county road taxes, state automobile license fees and gasoline taxes as those who live on the main roads and in the towns and cities, and rightly feel that it is an injustice to have to pay all the cost of their own local road, even if they admit that they do use the others in marketing their products.

There would seem to be no practical way of securing state supervision and no need for it in the case of such roads, but there is a very practical way in which aid may be given and the cost shared without undue burden and without adding to the machinery in existence.

*Financing Plan.*—If a revolving fund were created by the state to be alloted to counties as needed for such construction, the county to apportion the cost over a period of, say, five to ten years, collecting a fixed percentage each year either as special assessments or levies against property of the benefited district, without interest, the money would be building new roads every five to ten years and still be intact. The actual aid on a 6 per cent basis would be 15 per cent on a 5-year roads and 30 per cent on 10-year terms.

Counties might well use a 1 or 2-mill levy to pay 25 per cent of the cost of such roads and if this were done on a 10-year basis the property owners would actually pay about 45 per cent of the improvement. This, however, is not essential to the main plan.

We believe this permanent-working-capital or revolving-fund plan will meet with almost universal support both in city and country and that it offers perhaps the

simplest and most effective plan of encouraging the proper improvement of purely local market roads without running the risk of favoritism, political manipulation or wasteful extravagance.

In the petition to form such a special improvement district, it should be required that three property owners (unless a smaller number be involved) be named as trustees with full power to act. They should approve the contract for improvement and sign the special-assessment or tax-levy authorization before work begins. That would leave open only the question of performance of contract and this, of course, would be supervised by the county engineer or superintendent with right of protest for, say, 30 days after completion, thus closing the transaction.

Grading and drainage should be done by the county or township and should meet proper standards. Naturally, this type of road would not require the more expensive types of surfacing, while the small amount of traffic would mean low maintenance where built on proper grades.

We have made a good start on our arterial highways and it is high time the capillary system was given the attention it deserves. We believe this plan will help those that want to help themselves, that it is economically sound and politically practicable.

We have no hesitancy in predicting that if a state provided such a fund, guaranteeing its integrity as a permanent revolving fund for such improvement work and permitting private citizens to add to it either permanently or for a fixed term of years, substantial contributions would be made by public-spirited citizens who would like to contribute a share of their accumulations to the public welfare but find it increasingly difficult to assure themselves that money so donated gives value received to the people they desire to benefit.

It would perhaps be advisable to provide that such funds could be left specifically to a county, if desired, such additions not to interfere with state allotment. It might also be provided that any such funds not being employed in construction could be invested in certain classes of municipal bonds and the accumulated interest be used for maintenance. In this way, it might be possible that certain counties would eventually have an endowed road system.

Certainly it offers the primary attraction that it will only help those who are willing to help themselves and the even greater attraction that it will continue to do so as long as such improvements are needed—and who can say when the need will end? Even then we would still have the fund intact.

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## Road Conditions in Michigan

Michigan has about 81,000 miles of public highways, of which 7,770 miles are the state trunk line system; 16,000 miles, county road system; 58,000 miles, township roads. There are 83 counties in the state, all but 2 having county road organizations. Most of these county departments employ a highway engineer to carry out the work. The County Road Commission is best organized when the commissioners act in an administrative capacity only, leaving the execution of all construction and maintenance to the engineer or superintendent, according to Grover C. Dillman, State Highway Commissioner. The township roads are under the supervision of 1,376 local organizations and the work is usually of a maintenance nature.

# *Practical Plan for County Highway Improvement*

*By* CHARLES E. GRUBB
*Engineer-Executive, County Highway Officials' Division,*

A COUNTY road improvement plan is a prerequisite for orderly progress in the development of secondary highway systems in every county. During 1929 the states expended $900,000,000 for highways. The total mileage in state systems at the end of 1929 was 314,136 miles. During the same period counties and townships expended almost an equal amount, but on over 2,000,000 miles of roads. With this limited amount of funds for such a vast mileage, it is evident that an orderly program according to a definite plan is necessary to avoid waste.

*Practical Program Essential.*—Plans to be accepted must be practical. Vision of what the future holds for an area is fundamental, but a fantastic dream-plan presenting the ideal is beyond the comprehension of most counties. Such can be developed gradually. Beautiful layouts have failed to attract endorsement because they proposed changes too radical and involved indebtedness reaching staggering figures. We all advance by degrees. A community handicapped by impassable roads wants a practical program for road improvement, which can be paid for without burdensome taxation.

To produce a practical plan careful study and analysis of an area and its requirements are necessary. The county board needs facts. To assist themselves in collecting and interpreting these, they should, by all means, seek the advice of men trained to solve highway problems. These men will look far ahead to protect the investment and insure its salvage when changes, bound to occur in traffic, come about; but the program announced is more likely to win favor if its proposals are confined to a short period, 3 to 5 years.

If such a procedure is adopted, decisions which will follow will produce orderly growth. The greatest good for the greatest number, and the most in returns for the dollar expended. Elected officials will merit and enjoy the confidence of their constituents by contributing directly to their welfare in an economical manner.

*What the Survey Should Include.*—The fact-finding survey, as a basis for this plan, should include information concerning population, area, assessed valuation, industries and annual value of farm products. It should include a map showing the length, width, alignment and character of existing roads and bridges, all railroad grade crossings, the amount and kind of traffic and the local road-building material available. It should also include data as to the present yearly expenditures for roads, and present county road equipment. The county highway plan should determine a layout indicating additional roads for state improvement, roads for immediate county improvement, roads for delayed county improvement and those to be maintained only, as well as county roads for relocation or abandonment. It should show the proposed types of construction, the program for accomplishment and the set-up of an organization for administration. Finally, it should outline the financial features of the program, including the estimated cost of the proposed system, the annual maintenance

cost, the ability of the county to pay and the taxation necessary, with other possible sources of funds.

Outstanding counties demonstrate the possibilities of accomplishment when comprehensive plans are followed. Yet as these are few, the order of a county highway improvement plan for all of the counties is quite a large one. However, a plan is the foundation for logical progress. To assist in bringing about a realization of the benefits of planning and other improved standards and methods, the efforts of the County Highway Officials' division of the American Road Builders' Association are dedicated. Organizations of county officials in 31 states are likewise promoting similar improved standards of county highway operation.

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# *Progress in Secondary-Road Development*

## *An address before the National Rural Letter Carriers Association*

*By* STANLEY ABEL.
*Chairman, Board of Supervisors, Kern County, Calif.*

THE National Rural Letter Carriers' Association, which you represent, and the County Highway Officials' division of the American Road Builders' Association, for which I have the honor to speak today, have so much in common that I am sure it is agreed that we should work together on mutual problems, the solutions of which will benefit both organizations.

Members of your organization are charged with the responsibility of delivering mail daily to nearly 25,000,000 citizens over the 43,840 rural mail routes, while members of my organization are responsible for the maintenance and improvement of nearly all of the 1,316,420 miles of roads over which rural mail carriers travel daily. Not all of this enormous mileage is maintained as well as it should be, as county highway officials are called upon to build roads to serve all of the people. Few counties have funds adequate for the construction and maintenance of a complete system of highways and one of the functions of our division is to do everything possible to assist counties in establishing an orderly program, which will result in a complete system of highways and also permit roads already constructed to be maintained in good condition. We will appreciate your cooperation in that endeavor.

*Rural Mail Service and County Roads.*—The extension of the rural mail service, which began Oct. 1, 1896, has gone forward with the development of county roads. Some sort of road must be provided for the mail carrier. The rural mail service operating over roads constructed and maintained mainly by counties has in the past 33 years done much to improve the conditions of the farmer and his wife and children. Today there is no difference between city people and country people. They speak the same language, wear the same kind of clothes, have the same standards of living, and we are fast approaching an equality of peoples never before known in the history of any nation.

*Definite Progress Made.*—Definite progress has been made in our program of improving the secondary highways of the nation. During the past three years attendance of county highway officials at the road builders' annual convention has tripled. Technical magazines are devoting more space than ever before to secondary roads. National legislators in giving approval to the bill providing for additional Federal aid to states voiced the sentiment that in doing so they would hope and expect that the states in turn would make available additional money for improvement of secondary roads. Organized effort through state associations of county officials is being directed to secure state legislation to bring about this result.

Deliberations of committees studying county problems during this year have engaged the attention of more than 100 committee members, and, through the use of questionnaires, information for the studies has been gathered from more than 500 county officials in all parts of the country. The reports are superior in character and more practical in nature than those of any other year and we are convinced that the demand for these from county officials indicates that the facts they contain are being utilized. This is satisfactory progress. Much yet remains to be accomplished, Officials in many of the counties must be awakened to a full sense of their responsibilities. This is a matter of education. In this educational program the rural letter carrier can be of invaluable assistance. Through his daily contacts and in community meetings he can spread the gospel of better roads in urging that local groups insist upon their county having a highway improvement plan, and that this plan be adequately financed.

We were delighted to have a delegation from your association headed by your president with us at our convention in Atlantic City last January. We hope that this friendly interest will be maintained.

I extend to you the fraternal greetings of the thousands of county highway officials and workers of the 3,078 counties of the United States. Let us know how we can cooperate with you. We welcome your suggestions and advice.

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## By Way of Clarification

The article appearing in the September number gave costs of building retread surfaced roads with large gravel and the costs quoted were correct. As there has been some criticism that a road could not be built for that amount of money, it has been verified that the costs given only covered the items listed.

The grading of a road is a separate item, which was not included, and the other items listed vary in different parts of the country. Although rolling was not definitely mentioned it would be necessary, but it is an insignificant part of the cost.

The bituminous material quoted was given at 14 ct. Du Page County, Ill., is purchasing some at the present time for about 11 ct., which would more than make up for any cost of rolling.

No attempt was made to give the depreciation or overhead cost or a percentage of profit. However, the county just received bids for some of this type of work, for the top course 18 ft. wide, at a cost of about $6,250 per mile, with a 6 or 7-mile haul. This, of course, included rolling and everything complete for this top course.

The greatest advantage for this type of road, of course, is not on a new road where you have to build up a new base, but is for old roads where the base is already in and can be utilized as a part of the road.

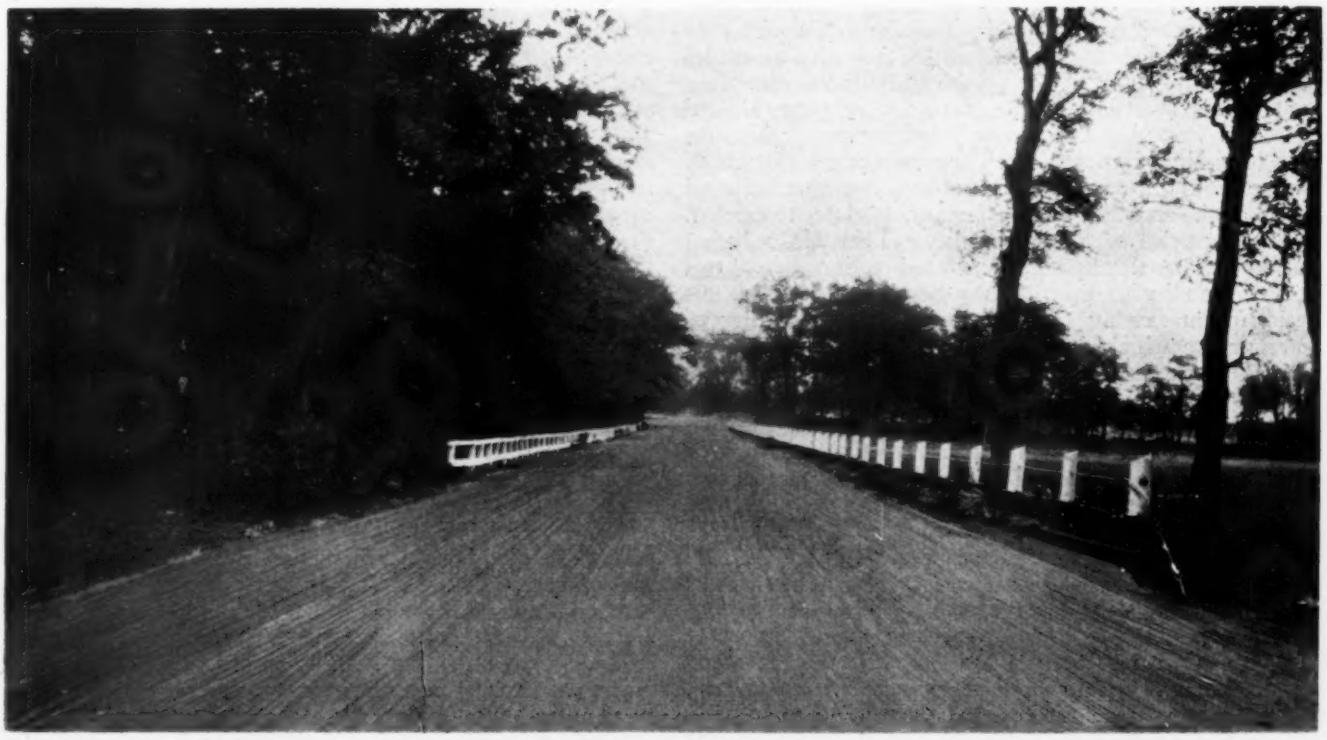
# *BEFORE*

Insufficient width, poor drainage and irregular alignment characterized the Rosedale-Lawrenceville road in Mercer County, N. J.

Why put up a guard-rail on this Burlington County, N. J., road? A motor car could not get out of the ruts to slide into the ditch

# *AFTER*

A penetration macadam surface on the widened, straightened roadway makes an all-season road now between Rosedale and Lawrenceville



Since the gravel improvement shown was made, Jackson Road requires a good guard-rail. Such improvements lower farm transportation costs

# *More* ADEQUATE, ECONOMICAL *Roads Required*

*One Reason for the High Cost of Medical Care in Some Rural Districts*

*Reduction of rural transportation costs will benefit entire nation; American Farm Bureau Federation promotion plan explained*

*By* NORMAN M. BLANEY

*Director, Farm-to-Market Road Department, American Farm Bureau Federation*

IN a survey taken a few years ago in the northwest, it was found that the average farm family pays for medical, dental and hospital care $104.94 a year. The average doctor's call is $7.63 and 13 per cent of the rural families pay more than $15 a call. This means that in a state such as Iowa the farm families spend approximately $21,000,000 a year for medical attention, a large portion of which is directly chargeable to high transportation cost due to inadequate roads.

This is still an agricultural country, founded and built on agriculture; consequently, the relationship of agriculture to the economic progress of the country is very decided and very marked. I do not believe it is necessary for me to dwell for any length of time at all on the place of agriculture in American life and economics. One of the main reasons for the so-called economic depression at the present time is the diminishing returns accruing to the farmers of the United States by lessening the farmer's buying power because of this diminishing return. There are many causes, of course, for this diminishing return, not the least of which is the inability of the farmer, to date, to control the selling price of his commodity. This will only become possible through concentrated action to control that commodity so that he may be able to regulate his period of marketing as well as regulate the quality of merchandise which finally reaches the consuming market.

*Tonic Effect of Good Rural Roads.*—Another factor in the diminishing net return to agriculture is the cost of production of the farm product. One of the major costs in the production of any commodity is the cost of transporting it to the consuming market. This cost of transportation can be reduced very materially by a more economic program of road construction, more particularly in our township and county roads than in our state and national highway systems. The reduction of this transportation cost will mean a great deal more to the man in the city than it actually will to the man on the farm. For instance, if each farmer were to save $1.00 on every load transported, it would not mean a tremendous number of dollars to him at the end of the year, but it would total $6,250,000 a load, which would ultimately find its way into the manufacturing industry from the farm. This naturally would be used for the purchase by the farmer of manufactured commodities, of necessities for the home, of building material, fertilizer, clothing and all the other things a family needs to buy. Consequently, these purchases would mean a very great amount of business for other industries and would add very materially to the payroll, thereby relieving a great deal of the unemployment, and would be of material assistance in bringing back to American business in general much of the losses from which it is suffering at the present time.

A great many other things are to be considered, other than lowered cost of production and transportation, in discussing the need of more economic road-building activity in rural America. For example, a very great many of our rural communities have been awakened to the necessity and the economy of consolidated schools, but on study of the question they find they must still retain the one-room schoolhouse with its excessive cost and lack of modern education facilities purely owing to the fact that consolidation of these schools means greater distance from the home to the schoolhouse and the existing lack of good roads makes this transportation problem one which cannot be surmounted.

*A. F. B. A. Program.*—As stated before, we have worked out a program which will lead to the building of more adequate roads of types such as will be the most economical for our members and rural America. Briefly our program is this:

Each of the 44 state farm bureau federations shall appoint a farm-to-market road committee to make a survey of state legislation, state finance, state distribution of moneys and state program of work. This committee shall work directly and in very close contact with the state highway officials and with the state financial officers. Included also in our program is the recommendation that each of the 1,800-odd county farm bureaus will appoint a county farm-to-market road committee whose objective shall be an analysis of the existing conditions within the county, not purely from an agricultural standpoint, but taking into consideration the other industries of the county and the methods they use in marketing their products. These industries, of course, which market their products by rail from a

*Fergus County, Minn., Road Outfit Starting on Season's Work.*

siding direct to the plant have very little direct interest in types or locations of roads. Such industries, however, as market their merchandise by road are vitally concerned with this subject.

The analysis of the county committee should consist of a survey taking these facts into consideration, as well as considering such matters as population and its distribution, types of products grown and manufactured and methods of shipping, the roads the automobile population uses, whether the use is for business or pleasure, topographical condition of the county, available road income, indebtedness and other related facts. It is possible that some traffic counts might add to the survey, although without the other data we do not consider traffic counts of any material value in such a survey.

The farm fire loss in the United States amounts to in the neighborhood of $150,000,000 a year. I need not point out the fact that it is impossible to organize five districts which will be adequate and which will be able to provide service unless we have roads over which the fire-fighting apparatus can travel.

*Economical Roads Necessary.*—I have tried rather briefly to give you an idea of the reason the American Farm Bureau Federation is sponsoring road building activities. This organization, however, very fully realizes that road building costs money, money means taxes and the farmer is bearing just about all he can stand at the present time. Consequently, a program has been worked out by our organization which will lead to the building of more adequate roads of types such as will be the most economical and without any increase of the present road income except in such cases as cannot be carried on without additional funds.

*Organization of A. F. B. A.*—The American Farm Bureau Federation is a group of approximately 1,250,000 farm people banded together, operating through county, state and the national federation for the declared purpose of advancing, promoting and protecting the interests of American agriculture. It is a non-profit organization controlled entirely by farmers. It is non-political insofar as men and parties are concerned. It does, however, devote a considerable portion of its time to legislative policies—county, state and national. It is, in the main, an educational organization, very closely allied to the Agricultural Extension Service of the U. S. Department of Agriculture and the various agricultural colleges and universities throughout the country.

We have state organizations in 44 states and county organizations in approximately 1,860 counties, these county organizations being broken down again into local township groups totaling in the neighborhood of 15,000. Association officers and executives are appointed by county, state and national boards of directors, which themselves are elected by the rank and file of the membership. We claim, naturally and justly, that our members are the more progressive farmers. We think this reasonable because, as you know, the more progressive people of any class are the ones who realize they must band themselves together in the particular organization which serves them for their own use.

*County and Township Roads Stressed.*—It is our contention that if a road is improved joining two towns, even though it be ten miles farther between points, a vast majority of the traffic traveling to either one of those two towns will use that road rather than an unimproved, shorter road.

We are laying almost our entire stress upon county and township roads not because we do not consider trunk lines important, but because other organizations, such as the American Association of State Highway Officials, are devoting their time to main highways and we would be duplicating effort to a certain degree if we were to devote our time to this subject. Another reason is that there are so many, tremendously many, more miles of county and township roads.

If you will go back into history as far as 1916 you will find it recorded in the Legislative Record that the American Farm Bureau Federation was one of the few organizations which stood for the need of a national network of roads such as we have today in our federal-aid system.

There is still another reason why we are devoting our time to county and township road activity and that is because, although we realize the very vital necessity of main highways, we view the entire network of roads somewhat as being similar to a large river and its tributaries. The main river would not be so large, nor would it carry as much water, if it were not for the existence of its tributaries. The main highway will be of material advantage to rural America, but it cannot be of as great advantage unless there is a means of economic access to it from the farm gate.

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## Counties in Oregon Will Build $2,000,000 Worth of Roads

Market roads in Oregon are improved by counties with the assistance of the market road department in the state highway commission:

Approximately $2,000,000 will be expended this year for construction, improvement and maintenance of market roads by the 36 Oregon counties, according to Roy E. Klein, Oregon state highway engineer.

The first half-year apportionment of $1,000,000 already has been made.

# The Road Builders' News

## *A.R.B.A. County Executive Committee Holds Successful Meeting at St. Louis*

The subjects of "Financing" and "Low Cost Roads and Bridges" were those of chief interest before the conference of the executive committee of the County Highway Officials' Division, American Road Builders' Association, which was recently held in St. Louis, Mo.

It was stressed by speakers that the urgent necessity of early attention to a vast highway mileage emphasized the importance of low cost roads.

The committee which had assembled from all parts of the United States discussed practically every phase of the county road problem under the direction of Charles E. Grubb, Washington, D. C., engineer executive of the division, and Stanley Abell, Taft, Calif., division president.

Topics which were debated included: road values and maintenance cost; classification of counties as rural and urban in allocation of funds; progressive improvement to protect the initial investment particularly in choice of bridge types for possible salvage value; state and county cooperation; relations between a county and special highway districts and townships within its limits; choice and care of maintenance equipment; dust prevention; ditch checks; standardizing of concrete mixes and design of mix; standardizing of asphalt terms.

A number of county engineers from various nearby states who met with the executive committee told of existing practices in their counties and there was a thorough discussion of present conditions and future possibilities in the county highway field.

The chief work before the executive committee was outlining the work of the many county committees in preparing their reports for presentation at the American Road Builders' Association annual convention in St. Louis in January. All the official group was taken on a tour of St. Louis and inspected the Arena and exposition buildings where the Road Show will be held.

Representative civic leaders met with the conference at luncheon and assured their cooperation for the success of the 1931 meeting.

Executive committee members stopped off enroute home at important cities in eight different states to discuss with county highway officials the research work and committee reports and to tell them of the satisfactory progress of division affairs and the splendid outlook for a most successful convention and road show in St. Louis.

## *Guard Rail Standards*

Creation of standards for the various types of guard rail on which many state highway departments may agree is the chief aim of the guard rail committee of the American Road Builders' Association, now being organized here.

Manufacturers of such equipment who attended a meeting of the committee were told by C. N. Conner, association engineer-executive, of results of a three months' investigation of the subject, which included a questionnaire sent to all state highway departments asking for all kinds of guard rail information.

The Pennsylvania highway department and various manufacturers have made tests and the data resulting from these is in the hands of the committee. A three-month survey was made of all available sources of information on guard rail with a view to standardizing the different types for the specific use to which they are to be put.

It was decided that representatives of manufacturers of the various type of guard rail, guide rail and guard rail fittings should be asked to assist with the work through committee membership. These types will include timber, wooden posts with cable, concrete posts with cable, timber posts with hub-high wooden rail and cable, mesh guard rail, chain link or woven wire, and special patented types. Other committeemen will be state, city and county officials.

As the report will be of interest to State Highway Officials, it will be presented first to the annual convention of that body in Pittsburgh in November and with additional data incorporated will be presented at the Association's annual convention at St. Louis Jan. 10-16, 1931.

## *Research on Road Grading*

Solution of what is viewed by highway engineers as one of the major problems in road building is sought by the committee of the American Road Builders' Association which is conducting research on grading methods and grading equipment.

The work of this committee this year will be confined to a study of the construction and compaction of embankments. A report on the subject will be prepared and reviewed at a meeting prior to the annual convention of the American Association of State Highway Officials in Pittsburgh in November. All manufacturers of grading equipment will be asked to attend this meeting. A preliminary draft of the report will be presented before that convention, after it has been reviewed by the industry. The final report of the committee after its acceptance by the annual convention of the road builders' organization in St. Louis January 10-16 will be added to data collected over the past year on other phases of grading procedure and published as a grading bulletin.

This research committee is composed of engineers, manufacturers' representatives, highway officials, educators from engineering schools, members of the technical press and contractors. H. J. Spelman, chief engineer, state highway department Charleston, W. Va., is chairman.

The wide variation of specification requirements covering the simplest phases of excavation work is indicative of the need for this work in the opinion of M. de Glopper, Michigan state highway official and general chairman of the equipment committee.

The settlement in an embankment with the resulting pavement failure has a bad effect on public opinion, De Glopper declares, and the paving on a project is not judged by the miles of successful paving but by the short stretches that have failed.

In view of the fact that railroads have for years given much study to embankments a representative of the railroads will be asked to join the committee. A staff engineer will make a tour to study soils, hydraulic fills, use of tractor types and rollers for compaction and other equipment and methods, prior to drafting of the committee report.

## Traffic Signal Study Underway

Nation-wide adoption of existing standards for traffic control signals rather than creation of new standards is thought by the traffic control signals committee of the American Road Builders' Association to be the greatest need today in the traffic field.

The traffic group is a part of the association's equipment committee which is headed by M. De Glopper, materials and equipment engineer, Michigan state highway department. The traffic signals study is being undertaken at the request and with the cooperation of the American Association of State Highway Officials, and the committee which is in the process of organization here will consist of representatives of state highway departments, city and county officials and the leading manufacturers of signal devices.

It was brought out in the present session that traffic control and traffic signals are a specialized part of the highway industry, that the present situation is badly confused, due to many different standards and to honest differences of opinion among officials charged with traffic control, that present usage of thousands of different combinations of size, shape, coloring and lettering of traffic signs might be reduced to less than a score by proper standardization. The meeting called upon the manufacturers present to offer suggestions that would be indicative of the trend of modern practice.

"Many existing standards are based on opinions, rather than facts," declared Chairman de Glopper. "Committees working on the subject before had had too few manufacture members, and the practical knowledge which manufacturers can give is badly needed.

"There are plenty of standards now, but too little adoption of them. Not a single state highway department in the United States follows implicitly the code adopted by the American Association of State Highway Officials.

"The committee is seeking one set of standards to govern both city and country traffic. We expect our report to be based on the views of all the leading manufacturers and state, city and county highway officials who are interested in the subject. We hope to point the way toward further adoption and observance of the best of present standards. This knowledge will be gained from practical experiences of committee members and facts collected by them in actual traffic control work. We do not expect to confuse the situation still further by recommendation of any new traffic signs and signals or any new methods of traffic control. What is most needed as the committee now views the subject, is greater standardization of equipment and practice.

The report will be finally drafted at a meeting of the committee in Washington early in October. The committee will report to the American Association of State Highway Officials and the annual convention of the American Road Builders' Association at St. Louis, Jan. 10-16, 1931.

## Highway Transport Division Organized by A.R.B.A.

Owing to many urgent requests from many sources, a Highway Transport Division has been organized as a feature of the 1931 Road Show which is to be held Jan. 10-16 in St. Louis, Mo.

Buses, motor trucks, tires, bodies and all other motor transport accessories will be featured in the exhibit, and requests for space in this feature of the great exhibit have begun to come in rapidly, according to Charles M. Upham, engineer-director of the American Road Builders' Association.

Reservations for exhibits in all sections of the Road Show show no evidence of any business depression in the highway industry, Upham declared. The allocation of Road Show space will take place Oct. 16 and 17 in St. Louis.

Committees are busily at work preparing their reports for the 28th annual convention with which the exposition is affiliated and headquarters officials are very enthusiastic over the prospects for breaking all attendance records this year.

Staff Engineer James T. Burch, Jr., Charles R. Thomas, director of the city officials' division and Charles E. Grubb, executive of the county highway officials' division, all of whom have visited many cities and states throughout the South and middle West in recent weeks, declare that there is widespread evidence of a greater interest in the St. Louis gathering than any held in previous years.

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**This section, devoted to the activities of the American Road Builders' Association, will be a regular monthly feature of ROADS AND STREETS**

## Snow Removal Report Being Prepared

Manufacturers of snow removal equipment and state, city and county officials who have snow removal in charge will work together on a comprehensive report on that subject this year as a part of the research activities of the equipment committee of the American Road Builders' Association.

Manufacturer representatives who attended a series of equipment committee meetings here welcomed the opportunity to assist with the association work. The studies have been suggested by the American Association of State Highway Officials and the American Road Builders' close affiliation with the manufacturers gives the committee an excellent opportunity to secure their viewpoints.

"Former animosities between manufacturers and engineers in the highway field are forgotten—they have no secrets now," declared M. de Glopper, Michigan state highway official and equipment committee chairman. "We must have full representation from the manufacturers on each committee."

W. F. Rosenwald, maintenance engineer, Minnesota state highway department, was named snow removal chairman and the representatives of manufacturers and highway official groups will be chosen soon. An airport engineer will also be named on the committee, as it was pointed out that snow creates a safety hazard on airports, and its removal is a very difficult problem and a different one from that of highway and streets.

Chairman Rosenwald stated that in many highway departments, no preparations are made for snow removal, as the summer maintenance organization handles the problem. The committee further discussed all types of equipment for the work; snow removal methods, which vary in cities and rural highways; snow control by fences and other devices; use of chemicals in elimination of icy pavements; speading sand or cinders over business streets on packed snow; use of heaters to thaw snow on streets and airports, where the problem is one of disposal rather than removal.

The committee decided to collect further data on equipment and methods, on snowfall in various states and expense of snow removal. The report will be presented to the annual meeting of the American Association of State Highway Officials and to the American Road Builders' Assocition annual convention which is to be held in St. Louis, Jan. 10-16, 1931.

# New Equipment and Materials

## Bay City Shovel with Allis-Chalmers Power Plant

A one-man tractor shovel, designed for high speed operation and powered by an Allis-Chalmers Model U tractor, has been developed by Bay City Shovels, Inc., Bay City, Mich.

This unit is mounted on long, full crawlers which carry a pressure of only 6 lb. per square inch of ground surface. Working weight is ten tons. Construction is all-steel throughout, gears are machine cut and shafting of special analysis.

*Bay City Shovel with United Power Unit*

Timken and Hyatt roller bearings are used. The shovel has ⅜ yd. capacity.

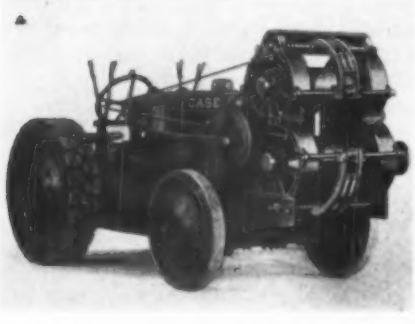
The machine is quickly convertible from shovel to clamshell, dragline, trench hoe or skimmer, one man operating in each case. It has three propelling speeds up to four miles an hour.

The Bay City tractor shovel is not an attachment for the tractor, the Allis-Chalmers power plant being installed as a permanent unit.

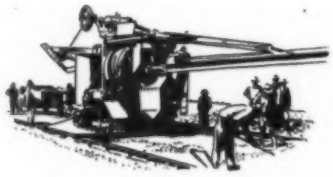
## New Model Trackson Hoist for Case Tractors

The Trackson Co., Milwaukee, Wis., has brought out its portable hoist in a new model known as the "HC," which is adapted to mounting on the Case Model CI (Industrial) and Model C (Agricultural) tractors.

The Model "HC" Trackson Hoist has many improvements and additions. Some of these are as follows: over-sized drum shafts, stronger frames, improved clutches and the Trackson level wind which prevents the cable from criss-crossing and bunching up. Operation is extremely simple and all of the controls are in easy



*Model "HC" Trackson Hoist for Case Tractors*



reach of the operator. Also, all moving parts are shielded.

Like other models of the Trackson Hoist, the Model "HC" can be obtained either as a single or as a double drum unit and either can readily be converted into the other type by merely mounting or detaching the upper drum. Owners of the single drum unit can easily add the upper drum and thus make their hoists suited to all work where a haul-back line is necessary.

## Traffic Liner

A simple device for marking traffic lines on highways has been placed on the market by Walter S. Nissly, 43 North Clinton St., York, Pa. The paint applier is on the side of machine, in full view of the operator, and has spring controlled arms which hold it plumb to the road surface regardless of the angle and movement of the machine. The applier is made of aluminum, strung with a good

*Nissly Traffic Liner*

quality of bristles. The capacity of the paint tank is 7 gal. The operating pressure required is only 6 to 8 lb. which is obtained by only 15 strokes of the pump which is conveniently carried on the machine at all times. One filling of air will discharge one filling of paint. The paint is released from the paint tank by turning the handle grips, which governs the flow of paint. When cleaning the paint tank air pressure can be applied which is a rapid method of cleaning machine and discharging unused paint.

The Nissly Traffic Liner is constructed with the applicator on the side of the machine with spring controlled arms which holds the applicator plumb to the road surface regardless of the angle and movement of the machine.

The machine is mounted on adjustable, rubber tired, ball bearing wheels.

## New Truck Body for Rubbish Collection

A new type of large-capacity rubbish body, mounted on a Fageol Flyer chassis, is illustrated.

It was built and installed by the Wood Hydraulic Hoist & Body Co., at San Francisco for service of the Modesto, Calif., Garbage Co. The body capacity is 9 cu. yd., and with it is mounted a Wood Model F-2 underbody hydraulic hoist, for easy, quick dumping of large loads.

*Nine Cu. Yd. Capacity Rubbish Collection Body*

The unusual flared sides, with the side opening for easy loading of rubbish draw attention, as also do the seat, seat box, steps and tool boxes forming part of the unit. This is one of many special units and unusual designs required for unusual or special service that have been produced by the Wood Hydraulic Hoist & Body Company, at San Francisco, for West Coast users.

## Byers' ¾-Swing Shovel

A convertible ⅜ yd., ¾-swing clean-up shovel weighing less than 10 tons has been brought out by The Byers Machine Co., Ravenna, O.

This machine is designed similar to Byers' full circle models in its machinery arrangement. The direct type of drive from motor to jackshaft by silent chain and then to each working operation is exactly the same in principle as is found on Byers' ½, ¾, 1 and 1¼ yd. machinery decks. All deck machinery is mounted in one unit steel casting; Timken roller bearings, worm boom hoist and power clutches also are similar.

The crawlers operate similar to Byers' full circle machines with double steer through a single 5¼ in. diameter travel shaft in the carbody. Independent cable

*Model 40, ¾-Swing Convertible Shovel*

crowd shovel attachment, clamshell, dragline, trencher and skimmer attachments are handled easily. The shovel crowd operates by cable and is reversible by a single independent lever similar to the crowd on Byers' larger shovels. This machine has a 36 hp. motor which develops a powerful single line pull at 140 ft. per minute.

## New Automatic Wind-Up for Crawler Wagons

The new automatic wind-up for Western crawler wagons announced recently by The Austin-Western Roads Machinery Co., Chicago, Ill., permits the tractor operator to remain in his seat and dump a heavy load by simply giving the lever cord a light pull. When the load goes down, the doors remain locked in open position. After the wagon has cleared the pile, a second pull causes the doors to fly shut, due to a strong spring, safely

*Western Crawler Equipped with Automatic Wind-Up*

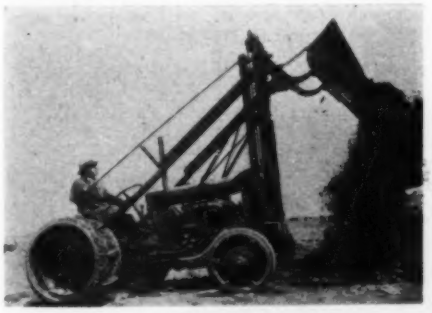
enclosed in a cylindrical-shaped housing, mounted on the rear of the main supporting frame. The dump boss can handle the load in the same fashion by operating a cord at side of wagon, if desired.

## Blair Digger for Allis-Chalmers Tractor

The W. M. Blair Mfg. Co. of Chicago recently announced a Blair hydraulic digger for Allis-Chalmers Model U tractors. This unit can be mounted on either wheel or crawler industrial models.

A bucket of ½yd. capacity is stated to handle 20 to 25 yd. of loose bulk material per hour. It also is claimed to pick up loose material such as ashes, crushed stone, fertilizer or dirt, carry it 100 ft. and dump it at the rate of 15 to 20 yd. per hour.

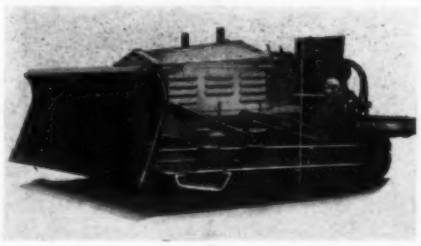
The pump on this digger is mounted on the side power take-off of the tractor. The cylinder is of Shelby seamless steel tubing with a 5½ in. piston. Total lift of the digger is 90 in. and dumping clearance 6 ft. 6 in.



*Model IU Tractor with Blair Hydraulic Front End Shovel. Wehr Double Duty Wheels with Cleats on Rear*

## Tractor Hydraulic Bulldozer Combination

The accompanying illustration shows the "80-60" Cletrac equipped with the Essex hydraulic bulldozer, manufactured



*Cletrac Equipped with Hydraulic Bulldozer*

by the Essex Engine & Machine Corporation, Belleville, N. J.

The height of the bulldozer blade is 48 in., the width 10 ft. and the length overall of both tractor and bulldozer is 15 ft. 2 in. The approximate weight of the bulldozer is 7,000 lb.

## Steel Faced Float for Road Contractors

A 12 ft. steel faced longitudinal float has been brought out by the Holtum Manufacturing Co., Freeport, Ill. It has a width of 6¼ in. and a finishing surface of 5½ sq. ft. It is equipped with four hardwood handles which can be lowered or raised to suit the operator. The float has a wooden core with aluminum trimmings to assure lightness, and a one piece steel face and sides. It weighs 75 lb.

## Rubber Crawler Feature of Galion Grader

Another new development in motor grader construction—the Galion Sure-Trac rubber crawler—was recently announced by the Galion Iron Works & Mfg. Co., Galion, Ohio. This rubber crawler provides the grader with smooth, continuous track with positive traction under all working conditions.

Sand has little or no effect upon the rubber crawler, as there are no links or sprocket teeth. The gripping action of the rubber easily carries the crawler over large stones or rough soil and the drop is made without shock to the machine.

Galion E-Z Lift motor graders are powered by the McCormick-Deering 20 industrial tractor. Equipped with the Sure-Trac crawler a higher operating speed may now be attained, as the rubber track is designed and constructed to stand up under high speeds. Operating economy is also assured by a guarantee of 5,000 miles of service. Tire chains, easily placed and removed, may be used with the Sure-Trac crawler when working in unusually slippery soil, or in snow and ice.

## Miami Tractor Power Shovel for "Caterpillar" Tractors

A new piece of equipment produced by the Miami Trailer-Scraper Co., Troy, O., is the Miami front end shovel for "Caterpillar" tractors, Models 10, 15 and 20. This shovel is manufactured in both low and high lift models, the low lift having a dumping clearance of 30 in., while the high lift has a dumping clearance of 6 ft. The low lift shovel is manufactured especially for the quick economical movement of loads of materials short distances. The high lift model is used extensively in the loading into trucks or bins.

The Miami shovel is furnished complete, no extra tractor parts being required in setting up. It has a capacity of 8 to 9 cu. ft. for the Model 10, ½ yd. for the Model 15 and ¾ yd. for the Model 20.

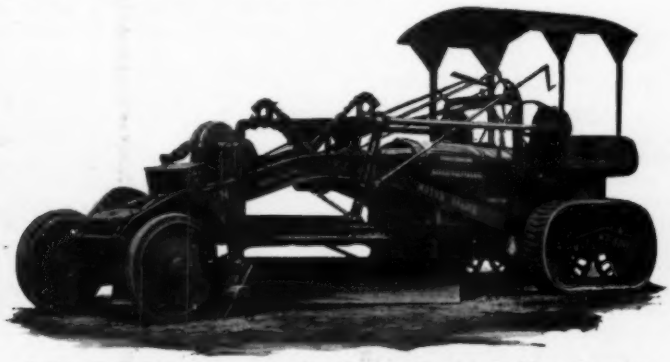
The shovel is constructed of high carbon plate, strongely reinforced by angle irons. The overhead cable carrying frame is hinged to the tractor treads to equalize the treads in operation. The operating cable provides for an equal lift on each side arm. A short-circuiting device is provided so that the shovel may not be

*Miami Tractor Power Shovel*

raised beyond a stated maximum height.

The shovel bucket is dumped by means of a dumping lever and rope, the shovel then being righted to its original position by a righting lever and rope.

This unit interchanges with the Miami bulldozer. In changing to bulldozer equipment it is necessary only to remove but four bolts where the shovel attaches to the extended axle in the tractor. The unit also interchanges with the Miami backfiller as well as the Miami wheeled scraper.



*Galion E-Z Lift Motor Grader Equipped with Rubber Crawler*

## Barber-Greene Announces New Large Size Bucket Loader

As an addition to their standard line of crawler and wheel type bucket loaders with capacities ranging from 1 to 1¼ yd. per minute, the Barber-Greene Co. of Aurora, Ill., has announced a new large capacity loader—the Model 62 crawler-mounted bucket loader. This new machine has a height of 19 ft. 4 in., a clean-up width of 7 ft. 6 in., and a capacity of 2 cu. yd. a minute. It is a crawler-mounted, power-propelled, one-man loading unit.

Many of the standard B-G features appear on this new machine. It has centralized control. Steering levers, master clutch pedal, transmission shift lever, power boom hoist lever, bucket line drive lever, crawler speed change lever, and scraper hoist wheel are all centered about the operator's platform. Although much greater in size and capacity, the Model 62 may be operated by one man as easily as one of the light Barber-Greene loaders.

For insurance against strains due to overload, the patented overload release sprocket is present.

The loader feeds itself by means of two large 42 in. discs that revolve inward toward the buckets. These discs are

*New B-G. Bucket Loader*

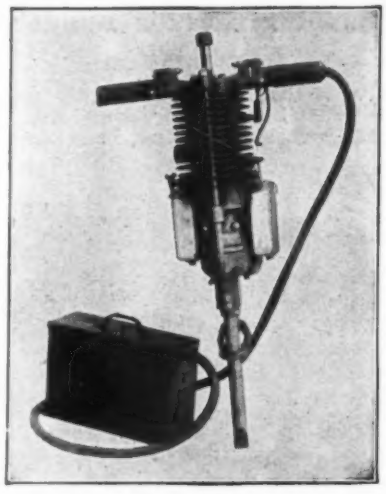
flat on the ground and slide under the pile or into the bank. The floating, adjustable scraper cleans a path 7 ft. 6 in. wide.

The patented floating boom is designed so that the thrust from the feeding end is transmitted direct to the crawlers, and the power from the crawlers is used most efficiently.

## Gasoline-Powered Hammer

A portable gasoline-driven tool for breaking concrete, driving sheeting, digging frozen ground, tamping and similar purposes, has been placed on the market by the Rodax Corporation, 110 S. Dearborn St., Chicago, Ill. The machine is manufactured by the Le Roi Co., Milwaukee, Wis., well known manufacturers of gasoline engines.

The Rodax weighs only 87 lb. It has a single-cylinder, 2-cycle motor with the ignition timed directly off a floating piston. The solid piston, which



*The Rodax*

acts as a hammer, strikes an anvil which is in contact with the cutting tool. The piston is returned to firing position by a combination of springs. There are only three moving parts. The speed of the hammer is 1,000 blows per minute, and it takes any standard 1⅛ tool.

A gasoline tank with a capacity of two quarts, sufficient for 2½ hours' operation, is bolted to and is an integral part of the machine itself. Ignition is supplied by a hot shot battery through a small coil connected by a cable through the handle to the timer and spark plug. The machine is started by a downward push of a plunger at the top.

## Device for Filling Tanks of Road Machinery

A practical device for filling the engine fuel tank from a barrel or other container without waste is a product of the Motor Improvements, Inc., Newark, N. J. It can be installed on any tractor, road building or excavating machine.

In filling the fuel tank, a filler head fits into the opening on the fuel tank. From this head a connection is made to the intake manifold on the engine by the use of a copper tubing and rubber hose. This connection remains permanently on the engine. Also from this head runs 10 ft. of hose, on the end of which is a 12-in. tube which enters into the fuel container. With the engine idling, a vacumm is formed in the fuel tank which causes 10 gal. of fuel to be transferred into the engine tank from the fuel container in approximately one minute. When the fuel tank is being filled, the fuel gradually raises an aluminum float in the tank filler head and when the tank is filled the float automatically cuts off the vacuum which stops the flow of fuel. Due to this feature, it is impossible to run the tank over or waste a drop of fuel. On the end of the filler head is a strainer which prevents any dirt or other foreign matter from gettting into the fuel tank.

In order that the fuel tank filler may work satisfactorily, it is necessary that a perfect vacuum be formed in the main fuel tank. This means that while the tank is being filled, the engine must run with the fuel from the auxiliary tank and the main taink must be shut off. For those tractors that do not have an auxiliary tank an auxiliary tank can be furnished, at a small additional cost, which can be connected into the fuel line leading from the main tank to the carburetor. There is a check valve in this tank which cuts off the flow of fuel from the main tank to the auxiliary as soon as the vacuum is applied to the main tank.

## A New Semi-Crawler Track for Tractors

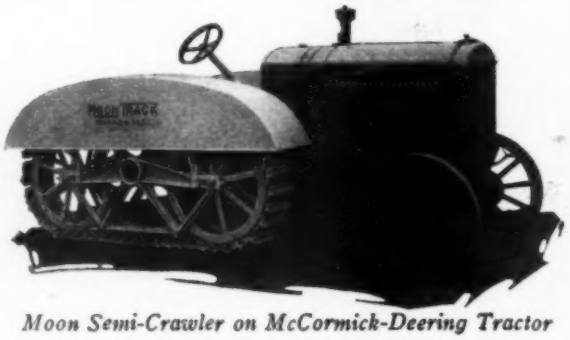
A semi-crawler track for the McCormick-Deering industrial tractors, Model 20 and Model 30, has been announced by the Moon Track Co., McCormick Bldg., Chicago, Ill.

Steering is easily controlled through the regular steering mechanism, including the two front wheels; thus, the tractor is of the four-point, ground-contact type.

These tracks are stated to portray a new feature in track construction. The driving pinions are in the center of the track, operating on both the top and the bottom of the track regardless of its position. The pinions are of manganese steel, similar to the material used on railroad frogs.

Another feature is that the shoes are self-cleaning. They are held together at one point only by a special bolted pin. This single shoe pin permits the shoes to open and close twice in every travel around the track. This opening and closing cleans the tracks of mud, clay, ice, or any other material that they are traveling over. Two types of shoes are available, either smooth tread for road work or sharp tread for loose ground work. Cleats can be supplied for the round tread. The shoes are reversible, thus doubling their life.

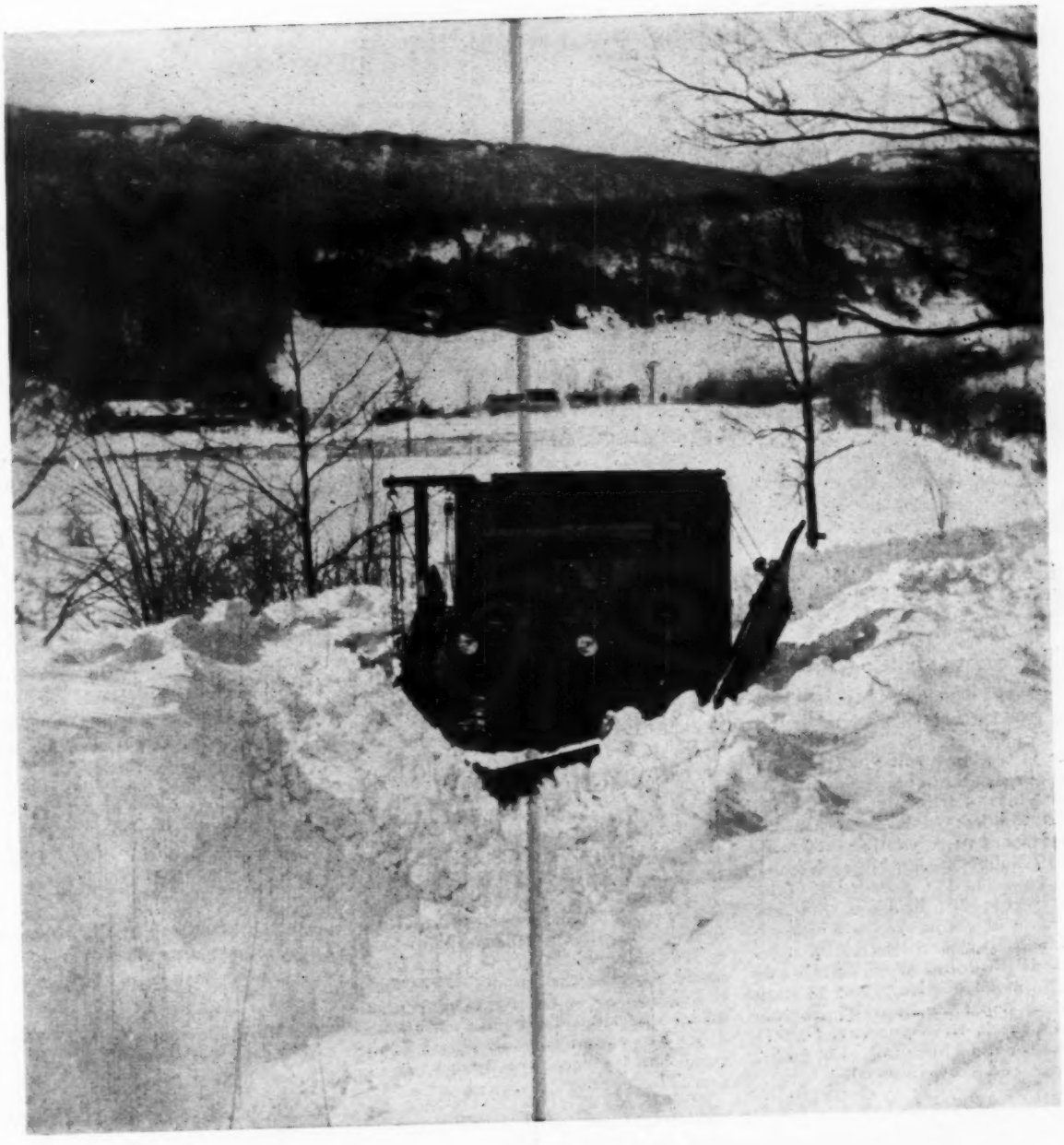
These tracks are quickly interchangeable with the wheels. The change can be made in about an hour's time. It is merely necessary to remove the rear wheels and fit the tracks on the axle; thus, in cases where speed supersedes the factor of traction, the wheels can be used and little time is lost in making the change. Moon Tracks fit on present McCormick-Deerings, as well as being supplied with new tractors.



*Moon Semi-Crawler on McCormick-Deering Tractor*

*A Section Devoted to*

# SNOW REMOVAL



*The symposium on snow-removal methods presented in the following pages is a digest of the experiences of state and county maintenance engineers who are adequately qualified to deal with the snow problem. The November Snow Removal Section will be devoted to an equipment review*

# It Won't be Long Now...


# the Fight Will be On!

**THE annual battle with Old Man Winter will begin again as usual in the latter part of the year. He will be in excellent condition. The bout starts with the first snow fall and lasts until spring.**

Here is the way some of the state highway departments are going to meet him: California will use 17 FWD trucks; Idaho will use 20; Maryland, 66; Wyoming, 24 new FWDs; Nebraska, 10; Massachusetts, 102; Iowa, 170; Colorado, 8; Ohio, 18; Oregon, 50; Montana, 30; and the state of Minnesota will use approximately 200 trucks in its snow removal program, of which 48 will be FWD trucks. Altogether, 34 state highway departments and 5 provinces of Canada have purchased FWD trucks for road building, road maintenance and snow removal.

In snow removal the FWD holds to the road and goes straight ahead into the snow; there is no swerving or lifting of the front end of the truck. It does a straight clean job the first time through; there is no need to go back over the road again to "straighten it out". Whether the truck is being used to break the first opening through the snow or whether it is being used to move back a heavy bank; whether the impact of the snow is head-on or whether it is concentrated on one side of the plow, the FWD holds its ground the full length of the run. And it steers as easily as a touring car. That's a fact.

*Write today for folder showing many different kinds of plows mounted on FWD trucks.*

**THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin**
**CANADIAN FACTORY — KITCHENER, ONTARIO**

**Drives through front and rear wheels, brakes on all four wheels.**

• •

**Steers as easily as a pleasure car.**

• •

**A general service truck which adapts itself to special needs and provides more than economical transportation.**

• •

**Furnished in 2 to 10 ton sizes, including four wheel, six wheel and tractor trucks.**

• •

**Manufactured by the oldest and largest manufacturer of four wheel drive trucks in the world.**

• •

**Have increased in sales 1084% in the past eight years.**

• •

**Received 62% of 1929 orders from owners of FWD Trucks.**

**BACKED BY NATION** FWD **WIDE SERVICE**

**TRUCKS**

Yes—we would like you to mention ROADS AND STREETS.

# Applied Science, Information Service,

Cindering an Icy Road

# BATTLE WITH SNOW

*Tactical employment of equipment characterizes Pennsylvania's campaign; 2-in. snowfall signal for attack*

By W. A. VAN DUZER

*Assistant Chief Engineer, Pennsylvania Department of Highways*

TINY flags and varicolored pins dot a large-scale map of Pennsylvania in the office of the equipment engineer at headquarters of the Pennsylvania Department of Highways. The network of highways is divided into sections, in charge of superintendents. In each district flags tell the weather and the forecast for the next 24 hours, so that snow-fighting forces may be marshaled and started in a few minutes. Like a general in charge of an army in the field, this chief in headquarters has up-to-the-minute reports on the enemy's activities and whereabouts. Units of the army have standing orders to attack when the snow reaches a depth of 2 in.

The department's field forces are grouped in 53 maintenance districts, each in charge of a superintendent, whose office is at the equipment storage shed. The shed is simply a garage of special design and construction to house the equipment and facilitate repair. In 99 sheds snow equipment is ready for instant use, while in districts which have the heaviest snowfall each year some units are stationed at other points, within easy striking distance.

*Plows Start When Snow Reaches 2-In. Depth.*—A watchman at each shed notes the first snowflakes and keeps an eye on the depth. Plowmen are warned to be ready for call and at a depth of 1 in. the crews are called out, getting the equipment in readiness. When the snow attains a 2-in. depth the plows start away, each with reserve gasoline, taking up a patrol of highways that lasts until the snowfall ceases and every road is cleared and widened out. If winds persist in drifting the plows stay on the job at such joints until the drifting stops.

Plows are mounted on motor trucks and tractors, equipment that ordinarily would be out of service during the winter season when road construction cannot be carried on. The moldboard type is a straight blade mounted in offset and swung low to barely scrape the road surface. It piles up the snow in front of it and the forward motion of the trucks forces the snow off to the right of the road. It sweeps a path about half the width of the road.

*Types of Plows Used.*—A V-plow is quite similar to the familiar farming implement but not designed to bite deep. The point or apex cuts into the drift and forces the snow along the sides, the greater width of this plow causing the snow to move back on each side and leave most of the roadway clear. This unit finds its chief employment in breaking through drifts so that moldboard plows may be used to widen-out and clear the entire road surface.

Rotary plows are the heavy artillery, reserved for stubborn drifts that defy lighter equipment by the very weight of the snow. These are spotted at scattered points so that any locality may be reached within two hours.

The rotary is a combination of a modified V-plow, the blade forcing the snow upward to a revolving fan-like wheel that throws the snow high and clear of the road. The advantage is that a rotary lifts and throws while other plows simply push the snow into windrows at the side, the latter failing when the weight of the snow is superior to the tractive power of the truck.

*New Methods of Mounting Rotary Plows.*—Experiments conducted by the department have led to perfection of a new method of mounting rotary plows. Formerly they were used only on tractors specially equipped to furnish power, but the new unit mounts on a standard motor truck, used ordinarily for construction work throughout the season. A power take-off enables the truck motor to drive the truck and the plow at the same time, through a connection with the forward end of the crankshaft. The plow can be thrown out of gear when not in use. At the end of the snow season the entire plow unit will be dismounted and the truck put back in construction service.

Six hundred and fifty miles of snow fence is in position to cut down drifting in localities usually affected, and the first snowfall of last season officially recognized by the department proved easy for the forces. It was in the vicinity of Erie, and despite the 6 to 10-in.

*Rotary Truck Plow at Work*

depth, no roads were closed and traffic was only slightly slowed down.

The effect of trees as permanent snow-breaks to prevent drifting is studied by the department's forester, who is working out a program for planting. Trees have been known to cut down frost action on paved roads through absorption of moisture at the roadside.

*Method of Cindering Ice Stretches.*—Cindering was initiated in Pennsylvania and since has been adopted by other states, modified by some who find cinders unavailable. Sand and other substitutes are employed but cinders have proved superior and remain Pennsylvania's chief weapon against the skid hazard at curves, grades and railway crossings and at such highway intersections as require them. Motorists may thus make emergency stops with safety and are not surprised, on rounding a curve, by an icy highway; absence of the cinders with the momentum of the car and the natural exertion of centrifugal force would render icy stretches of the road tragic, as was often the case.

The department's laboratory, after considerable study, devised a plan to spray the cinders in storage with a solution of calcium chloride, akin to common table salt and a thawing agent. The chemical causes the cinders to penetrate and imbed in the ice, making a permanent tractive surface as long as the ice remains. Cinders without the chemical were found to scatter with the passing of vehicles or slide with the wheels when brakes were applied, and required replacement as often as three times a day.

A hint may not be amiss here as to the use of salt for thawing ice on the sidewalks at home. We have found that salt rapidly deteriorates a concrete pavement to the point that it chips and breaks down. Experience with dripping salt water from ice-cream delivery trucks led us to seek legal measures prohibiting leaking or sifting of material from vehicles, a costly business from the viewpoint of highway maintenance. The use of calcium chloride with the cinders is in such minute quantity that it is lost in the ice before it can harm the pavement.

At a cost of less than 50 ct. for each motorist in the state the department of Highways is able to do snow removal work worth at least $6,000,000.

*A $6,000,000 Direct Return from Snow Removal.*—The annual bill for snow removal on the state highway system is about $900,000. Returns come in from three distinct sources: (1) on the highway investment which would be lost two months each year if the roads were not cleared of snow, (2) from the people's investment in motor vehicles which would be idle the same period and (3) from savings in road maintenance and repair.

Valuing the state system of roads at something like $400,000,000, we arrived at a monthly interest return charge of $1,000,000 a month. With no effort to remove the snow blockade the roads would be impassable at least two months of the year, with a consequent loss of $2,000,000.

The maintenance bill, if no snow were removed, is estimated at $2,000,000 for the same period, considered as a very conservative figure. Clogged drains, freshets, washing and other erosive results would seriously damage all types of road. Another factor is the habit of motorists to follow the first trail broken through the snow, which would result in ruts in the pavement and a tendency to cracking.

With approximately 1,750,000 vehicles registered during the past year, more than $1,000,000,000 is invested in vehicles by the people of the state, who naturally expect a re-

*Left—Rotary Tractor Plow Stops to Have Its Picture Taken. Right—Some Hand Labor Done after Rotary Plow Has Gone Through*

turn on their investment. Using traffic counts and the ratio of cars using the state system, we make an interest charge of $2,000,000, the sum owners affected by snow would expect to get as a return.

In setting a figure of $6,000,000 as the direct return for our snow removal work, we take no account of the benefits to business houses and truckers, aside from their investment in motor vehicles. The $6,000,000 is only the direct return from the three sources mentioned.

The history of snow removal in Pennsylvania begins with the World war, when munitions and food were hauled in huge quantities to the Atlantic seaboard and overtaxed railroads were supplemented by truck trains over the Lincoln Highway. The department was asked by the Federal government to undertake keeping the highway open and passable throughout the winter. From the experience and cost data gained it was found economical to continue the practice and expand it, until now in Pennsylvania some 9,000 miles of surfaced highway are kept clear of snow. So far has it been developed that the department issued a "snow map" and detour bulletin, telling motorists that unless the radio or newspapers advise to the contrary, all roads on the snow program are open and safe for travel.

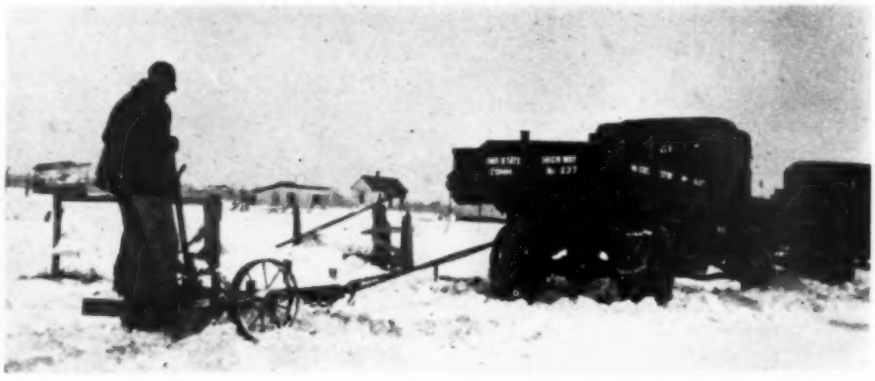
*Keeping Public Informed on Snow Conditions.*—A system of informing the public as to conditions links headquarters at Harrisburg with the maintenance districts; and the map, mentioned before, plots up-to-the-minute information. Maintenance men inform their local newspapers and news wires, while headquarters furnishes bulletins to radio stations throughout the state and to resident correspondents of the metropolitan newspapers and news wires, telling state-wide conditions, through our bureau of publicity and information.

Compared with a period only a few years back, when winter found virtually every motor vehicle blocked up in the owner's garage, the advent of winter now means just keeping an eye on the radiator to see that it doesn't freeze.

Ordinarily a bond salesman promising returns of six-for-one would be locked up, but if the highway department sold bonds for snow removal on the same terms motorists have already demonstrated that sales would be rapid.

# Indiana Increasing Winter Maintenance Activitities

*By* A. H. HINKLE
*Superintendent of Maintenance, Indiana State Highway Commission*



*Removing Ice from Surface with Two Liberty Trucks Towing a Subgrade Scarifier 4½ Miles West of Princeton, Gibson County, Ind.*

DURING the winter of 1929-30 the Indiana State Highway Commission expended about $90,000 for snow removal. This sum is exclusive of equipment, which perhaps should be estimated at not less than half of the amount. The snowfall was much heavier than in the previous winter, and the cost of removal was accordingly greater. Snow-removal equipment operated included 107 displacement plows on trucks, 1 truck-mounted rotary plow, 3 displacement plows on tractors, over 250 road graders and other miscellaneous equipment, some of which was home-made. Over 600 heavy trucks are available for snow removal and are pressed into use whenever the work demands.

While in 1928 and 1929 the records show that snow was cleared from 3,715 miles of Indiana highways, in 1929 and 1930 snow-removal activities extended to nearly 4,600 miles. Heavy snowfall during the past winter necessitated much more snow-removal work than has been required in the past history of the highway commission. The increasing through traffic is also insistent in demanding that every road be kept open for traffic throughout the entire winter.

*Left—Bucking Snowdrifts with 2-Ton F. W. D. Truck and Push Plow ½ Mile North of Intersection of Routes 43 and 2. Right—Blockade from March Snowstorm 4 Miles East of Michigan City, Ind.*

# *Some Important* Snow-Removal Problems

*Truck Plow Widening Michigan Road*

*By* S. J. STEWART
*Resident Maintenance Engineer; Michigan State Highway Department*

ADEQUATE and satisfactory snow removal is one of the greatest problems that confronts the maintenance engineer, as the atuomobilist is now impatient, and quite rightly so, with closed or unsafe roads due to an unnecessary surplus of snow or ice.

Some years of experience and thoughtful observations have led me to believe that the items outlined below might be informative to those engaged in this particular maintenance activity. This is written for those actually engaged in snow removal, so minor details have been omitted.

*Drift Prevention Important.*—As we all know, the avoidance of drifts aids very materially in successful and economical snow removal, so every endeavor should be made to eliminate, if possible, all causes of snow drifts. It therefore becomes necessary to keep our roadsides clear of brush and weeds. This clearing should be continuous along the fence lines and for a short distance into the fields at all spots that observation tells us drifts are liable to occur. Many drifts are caused by small growth that does not seem to be of any moment during the summer and fall months, but which, at the beginning of snowfall, immediately begins to cause trouble by starting small drifts which soon become of a serious nature.

A generous use of snow fence throughout a territory soon pays for the original cost as well as that of erection and dismantling. An economical practice is to drive the fence posts in place before severe freezing weather, sometime in October. After the posts are solidly frozen in place, the fence should be erected. This method eliminates many troubles which may be encountered later on.

*You Cannot Gamble on the Weather.*—There must be no negligence or procrastination in having all snow-removal equipment in first-class workable condition, with all the necessary extra parts provided in case of a breakdown by Nov. 1 each year. Much annoyance and financial loss have been due to those in power making an unfortunate guess that the snow would not fall in any great amount previous to some pre-guessed date. It does not pay to gamble on the weather when possible to avoid it. No attempt to centralize the snow removal equipment should be allowed. It should be placed at the strategic points in the territory, such points being determined upon by previous experience.

*Types of Plows and Climatic Conditions.*—Where snow is deep, weather cold and comparatively little wet snow encountered during the season, the plows should not be of the push type, but of the type that rolls the snow from the sides. Where the climatic conditions result in much wet snow, the type of plow that simply pushes the snow is the more economical. For a territory of possibly two or three counties, depending on the amount of snowfall and general conditions, one rotary plow with a chute should be available for the purpose of widening the traveled path, as this method of widening the road is far more economical than the use of an ordinary plow with the addition of day labor.

**Mr. Stewart's advice is the result of experience and systematic observation. His remarks are for the benefit of those actually engaged in snow removal, minor details having been omitted**

Trucks with plows attached should never be allowed, with a few exceptional cases, to exceed a speed of 15 or 20 m. p. h. Where traffic and snow are light, visibility is clear for 1,000 to 1,500 ft. and the wind is blowing away from the road and the truck driver, a greater speed might be justified; but taking into consideration the possibility of accidents, in the long run the small economical advantage gained in greater speeds would be found to be offset by other factors.

Snow should be removed entirely from the wearing surface of the road. After the first snowstorm the snow should be removed beyond the ditch lines, and after every storm if it is practicable to do so. The organization should never be allowed to guess during a thaw how long such a thaw is going to last. If there is any slush on the traveled portion of the road, it should be removed at once, and if necessary, work should continue throughout the day and night until all slush has been removed, thereby avoiding dangerous ruts and sharp edges of ice.

*When the Plows Should Start.*—The organization should never be allowed to guess when the storm will

*Weeds Like These Cause Drifting and Should Be Cut*

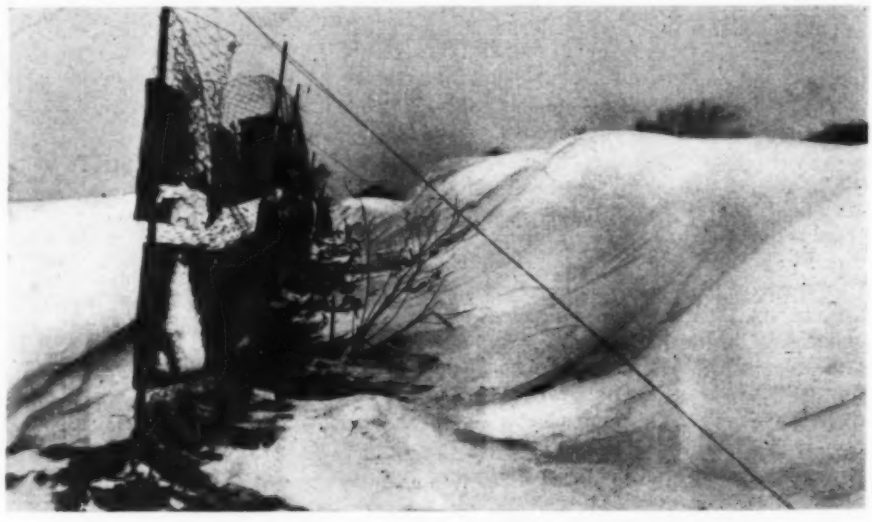
abate. Whenever there is a 2-in. fall of snow, all plows should be put into action immediately, and continued until the roads are clear. At times this may seem to be an uneconomical procedure after the snowfall has discontinued in a comparatively short time, but this small loss is overcome by the result obtained if the storm continues for several hours.

*The Snow-Removal Organization.*—One of the greatest factors in economical snow removal is the personnel of the organization. No equipment, howsoever good or up to date, can perform efficiently with careless, non-interested personnel; and much care should be taken by the official in charge to strengthen the morale of his men by encouragement and appreciation, as the work is hard, physical uncomfortable and of long, tedious hours. The official in charge must guard against petty fault-finding or any other action that has a tendency to discourage or lessen the enthusiasm of his forces. He should show outward appreciation of efforts and give commendation for work well performed. Never rely upon "pick-up" men for the skeleton of an organization. The skeleton of a snow-removal organization should be composed of men continuously employed throughout the season. When there is no snow removal there are many ways in which these men can be economically used, and they should be kept aware of the fact that they are to be used primarily on snow removal under all conditions of weather at all hours and at any time called upon.

Cost data on snow removal are of no practical value, as the original estimate is simply a guess on possible weather conditions. The cost data in various sections of one state are not comparative for any practical purpose, as they will vary according to the depth of snow, the intensity and continuity of temperature below freezing, the velocity of winds, the nature of equipment, the personnel of the organization, the intensity of traffic, the thoroughness of the removal of snow and ice from the traveled roadway and the width of clearance between snow banks on each side.

•

OREGON EXPENDITURES.—The total cost of the removal of snow from the state highways of Oregon during 1927 and 1928 was $273,053.26. Of this amount $135,237.00 was spent during 1927 and $137,816.26 during 1928.

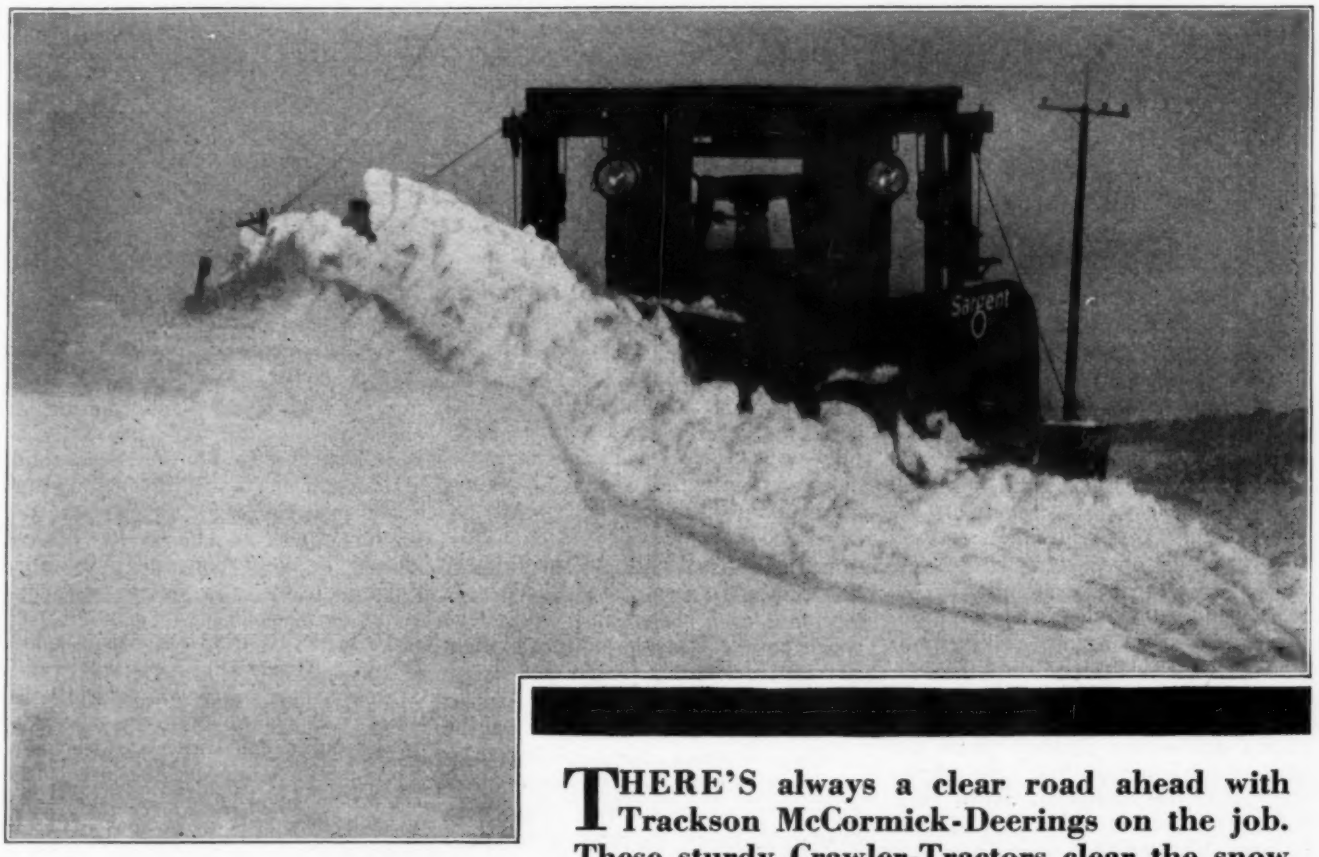


*Emergency Snow Fence of Chicken Wire and Chloride Bags*

## High-Altitude Snow Removal in Colorado

THE picture above, showing a Bucyrus 20-B steam shovel in a 20-ft. drift of snow just east of Fall River pass in Rocky Mountain National Park, in Colorado, was taken in the month of June. The dipper is 21 ft. above the roadbed. The drift lies on a sidehill section sloping 30 deg. toward the left. All snow was dumped on the lower side.

# Speed for the light falls
# Power for the heavy drifts



THERE'S always a clear road ahead with Trackson McCormick-Deerings on the job. These sturdy Crawler-Tractors clear the snow quickly and thoroughly, thus preventing the deep ruts from traffic which later cause thousands of dollars in road repair. Their speed and power meet the most rigid requirements of snow removal. Their low first cost and low operating cost meet the most conservative community budgets. Their fewer parts and sturdy construction assure long service and least upkeep. When winter is over they supply the sure-footed power needed for road building and maintenance. See your nearest Trackson dealer or write us for folder No. 214 and complete information.

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# Designing to Keep Highways *Snow-Free*

*Windswept Grade Line on North Dakota Road*

*By* H. E. FOWLER

*Assistant Maintenance Engineer, North Dakota State Highway Department*

***Snow-fighting begins with design of roads; items in North Dakota fall maintenance program bearing on reduction of winter snow difficulties***

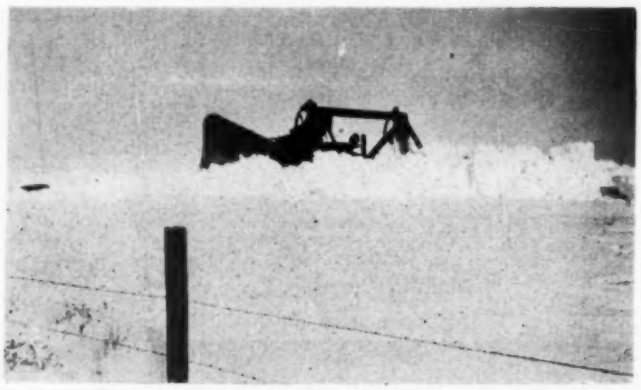
*No Removal Work Is Attempted While Wind Is Blowing*

OUR general snow-removal policy is to use three and five-ton four-wheel-drive trucks (tractor type) equipped with V-type displacement plows to open the roads immediately following the snowfall and subsidence of the accompanying wind. The same equipment is used for widening operations where sufficient speed can be maintained to throw the snow clear of the roadway and avoid ridging. This condition prevails where the snow is shallow and not packed or iced. For the heavier widening operations, rotary plows are used. Rotary plows are slow-moving units, but they throw the snow sufficiently to avoid ridging. Heavy tractors equipped with V-type displacement plows are used both for opening and widening where the lighter equipment is unable to do the work. However, these tractor units are comparatively expensive to operate, so their use is held to an absolute minimum.

*Snow Removal Work Waits on Wind Subsidence.*—Practically all our snowstorms are accompanied by a strong wind which usually continues for several hours after the snowfall is over. No removal work is attempted while the wind is blowing. To do so would only be a waste of time and money. Traveling conditions would be made worse than if no removal work had been attempted, and crews and equipment would not be in shape to do their best when the wind died down and more favorable conditions prevailed. Widening to the full width of the roadway surface, and avoiding ridging along the shoulders as far as possible, are considered very important. Widening keeps the road open longer after the beginning of the next storm (snowstorm or wind, or both) by providing more storage space for the drifting snow. Ridging along the shoulders increase the size of the snow drifts during the next storm.

*Snow Hazard Factor in Highway Design.*—Preventive methods tending to reduce the accumulation of snow on the highways are fully as important as, if not more so than, actual snow-removal in keeping our roads open to traffic throughout the winter months. The snow hazard should be kept constantly in mind during the location, design and construction of the highways.

Proper location involves many factors. While alignment and grades are of primary importance, if the locator will bear in mind the necessity of reducing the snow hazard to an economical minimum, he can often do much towards reducing snow-removal costs later at no loss either to correct grade or alignment. This is accomplished by locating the highways on high ground where feasible, by locating on the windward side of hills and ridges and on the leeward side of valleys, and by laying or clearly recommending grade lines where terrain conditions, not



*Left—Truck-Rotary Unit in Action in North Dakota. Right—Tractor-Displacement Plow Unit Pounding Its Way Through the Deep Drifts*

brought out in the routine survey notes, require special design.

Design can accomplish more to reduce later snow difficulties in a prairie country than any one of the preliminary steps. In fact, there is no doubt that over most of the area of our state design can reduce the expense of snow removal by at least 75 per cent and often practically eliminate any drifting on the roadway. This can easily be verified on many of our highways constructed during the past two years, which with no snow fence protection remained windswept and free of snow drifts throughout the winter and thereby open to traffic with no snow-removal work necessary. This result is attained by holding the grade line reasonably above the adjacent ground level, by avoiding shallow cuts—especially shallow cuts where the grade changes from a cut to a fill section or vice-versa—and by constructing wide ditches which furnish storage space for the snow. It has been our experience that cuts from 6 in. to 3 ft. below the general prairie level result in more difficulty in keeping the roads open to winter travel than do the deeper cuts. Through a deep cut it appears that a draft is created which largely tends to sweep out the deposited snow; at least sufficient roadway remains open for one traffic lane. Guard-rail, guard posts and other objects projecting above the grade line which start formation of drifts should be held to an absolute minimum.

*The Ideal Road for Winter Travel.*—The ideal road for winter travel would be a high, wide grade, with wide, flat-bottom ditches, constructed along the center of a 200-ft. right-of-way, clear of all obstructions which extend above the elevation of the grade line. On such a road the surface would be swept free of all snow by the winds, and this drifting agency, which causes us so much trouble on the highways as usually constructed, would be the factor which would largely eliminate our trouble. While for obvious reasons a highway cannot be so designed throughout its entire length, just so far as this ideal windswept road design is approached will our cost of snow-removal work be reduced.

*Drift Caused by Shallow Cut*

*Construction Details and Drift Formation.* — During construction, improvements can be made by the engineer in immediate charge of the work. Construction details often play a large part in starting the formation of drifts on the roadway. Minor topographical conditions overlooked by the locator without the completed design before him, and conditions not available for detailed study by the designer in the drafting room, can often be corrected as construction work proceeds. To cite one specific example, quite frequently under the fence line along the right-of-way boundary, a ridge of drifted soil has collected which is a few inches above the established grade line. By temporarily removing the fence and blading this accumulated soil back into the field and leveling, a real snow hazard will be eliminated.

*Fall Maintenance Procedure.* — Our maintenance procedure in the fall preparatory to reducing snow difficulties and hazards consists of (1) mowing all weeds within the right-of-way and beyond where deemed necessary, (2) removing planks on wood guard-rail (This obsolete type of rail is rapidly being replaced with the wire-rope type on all our projects where installed, due to its hazard to fast traffic, and will be entirely eliminated within the next two years.), (3) removing drifted soil ridges under fences, (4) erecting snow fence, (5) overhauling and putting into first-class condition all snow-removal equipment, (6) organizing snow-removal crews and (7) arranging for systematic reports to be submitted to district offices from points throughout the district immediately following each storm, etc.

*Snow-Removal Equipment.* — In carrying out its snow-removal program during the past season, North Dakota operated the following equipment, most of which is new and in first-class condition: 2 Snogos, 8 tractor units, 4 5-ton truck units and 8 3-ton truck units. Both displacement and rotary plows were available for the truck units. Heated shop and storage facilities were maintained at the seven district headquarters. A total of 1,622,000 line ft. of snow fence was erected. Power patrols were left at heated garages at various points throughout the state. These assisted in light removal work and in cleaning up after plowing operations; they were also used to take care of any surface maintenance work which might be necessary when thaws occurred. Section patrolmen were retained and rendered their assistance as far as possible with the means at their disposal. Operation of the snow-removal units were limited to 1,205 miles of the heaviest-traveled routes. Snow-removal expenditures totaled $171,600.

*Snogo in Action*

# Drift Control *on Wyoming Highways*

By G. W. Marks
*District Engineer, Wyoming State Highway Department*

*Two Lines of Permanent Snow Fence Are Often Built in Wyoming*

THE necessity of keeping all main highways open throughout the winter is now generally acknowledged, the only questions involved being method, effectiveness and finance. Throughout the snow belt, highway organizations are now preparing for the coming winter, knowing that the unexpected is almost certain to happen but hoping for the best. Every winter we profit from the experience of ourselves and others but the storm king will not acknowledge defeat.

The study of snow control comes under two heads, snow removal and drift control. Snow removal is a subject that has been frequently discussed during the past four or five years and authorities are now nearly agreed as to methods and equipment, depending somewhat on climatic and topographical conditions.

The success of snow removal depends to considerable extent on drift control and I shall confine myself to relating our experience with this type of work.

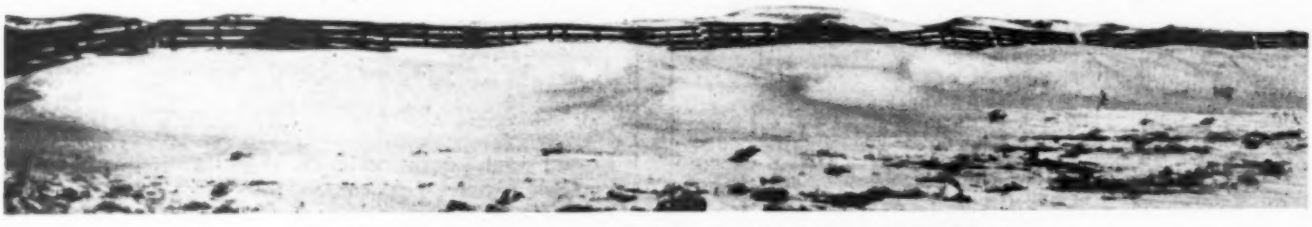
Many of the highways of Wyoming traverse high, wind-swept country and falling snow is constantly in motion until trapped in unexposed depressions, on the leeward sides of hills or behind other obstructions that will break the force of the wind. Drift control is one of the main considerations from the first completion of a project.

*Elevated Grade Line.*—In making a survey for a new location or relocating an old highway, the line should be so located that the roadway will be exposed to prevailing winds or located to take advantage of natural obstructions to trap drifting snow before reaching the road. All cuts should be avoided in the design; if this is impracticable in all cases they should be so placed that prevailing winds will blow through rather than over. In general design the grade line is carried an average of 18 in. above adjacent ground and when necessary to cut, the cuts are excavated 100 ft. in width and to a depth of 18 in. below grade.

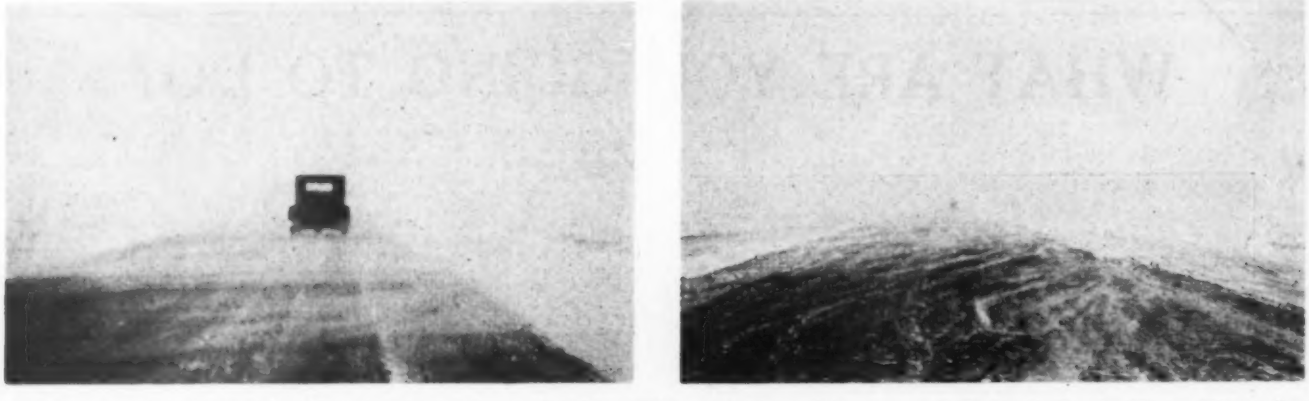
If cuts must be built that are not parallel with the prevailing wind, snow fence is placed as shown in an accompanying picture. We seldom set more than two lines of permanent fence, preferring to supplement with the portable panel type.

*Use of Portable Snow Fence.*—Often our roads become impassable during a prolonged storm and drift in faster than we can remove snow. It then becomes necessary to place some kind of protection before attempting to clear the roadway. The best results have been obtained by using portable panel snow fence. This stops drifting and permits the clearing of the roadway with truck or tractor plows. After the fence fills we reverse the panels and place the legs in snow banks. During the continuance of the storm, snow fence crews work resetting this fence and often we have evidence of their work as late as June.

Until Wyoming adopted these methods of drift control our snow removal was costly and more or less unsatisfactory. During the winter



*Snow Fence Is Part of Design of Wyoming Highways*



*Left—Windswept Grade Line in Wyoming. Right—Wide, Shallow Ditches and Raised Grade Keep Wyoming Highway Surface Free of Snow*

of 1929-30 we had several severe blizzards, but with the methods used we were able to keep traffic going with few tie-ups and comparatively little delay.

Correct highway location and design together with drift control are the economic factors in winter maintenance and if properly applied will result in large savings that would otherwise be expended in snow removal.

# Winter Maintenance *on Nebraska State Highways*

*By* A. C. TILLEY
*Maintenance Engineer, Nebraska State Highway Department*

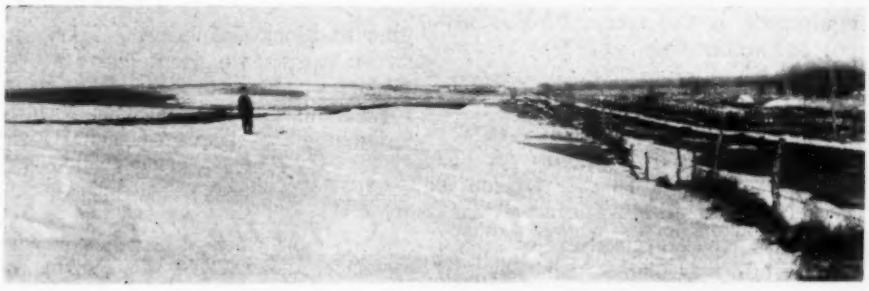
BECAUSE of the geographical position of Nebraska, we do not have the extreme winter conditions of the states north of us or the mountain states west of us. However, we are situated in the snow belt and snows varying from light falls to depth of 12 in. are common throughout about four months of the year.

Our topography varies from flat plains and rolling prairies, subjected to severe winter winds which sweep across the country unobstructed for many miles, to the hills bordering the Missouri River in the northeast and to the buttes in the northwest.

Only a few years ago motorists and car owners expected little in the way of winter maintenance and most of them put their cars away in the late fall and did not bring them out again until late spring. However, the great increase in the number of motor vehicles and the desire of the public to operate them during all seasons, together with the increased general use of the motor truck as a means of transporting livestock, grain and other commodities have now made it essential that the highways be kept open and in good condition at all times. As a consequence our winter maintenance has become most important.

*Advantages of Complete Snow Removal.*—We attempt to keep the snow removed from our entire maintained system of 6,658 miles. It is our policy to keep the road surface scraped entirely free from snow if possible to prevent melting on the surface. This prevents subsequent freezing and an icy covering on paved sections. On gravel sections it eliminates rutting of the surface which is certain to occur if the gravel mat is permitted to become saturated. On earth roads prompt removal eliminates a rutted, muddy surface, in case the snow is followed by a thaw. Also, once the snow is removed, our regular maintenance units are able to resume their daily smoothing operations, which are carried on in the same manner in winter as in summer.

*Snow-Removal Methods.*—To accomplish this our patrolmen start out while it is still snowing and remove all that they can with their motor graders or with tractors and pull-type graders. We have been very successful in handling 3 to 4-in. snows promptly in this manner except for occasional drifts. The drifts are removed either by trucks with snow plows or, in the case of heavy drifts, by the use of Caterpillar tractors with plows or 12-ft. blade graders. These machines work night and day until the drifts have been cleaned up and all roads opened.



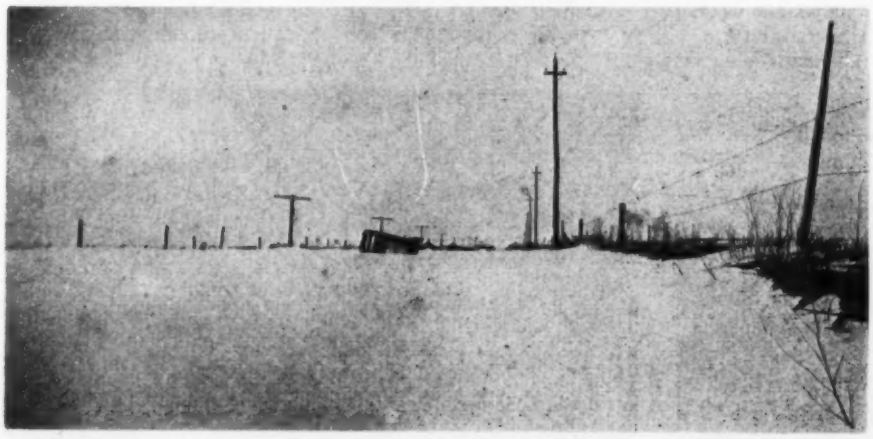
*Results Obtained by Properly Placed Snow Fence*

*Near Porter, Neb., in the Wake of a V-Plow with Wings, Mounted on a Caterpillar Tractor*

By the erection of approximately 500 miles of slat snow fence, which we have found very successful, we have been able to protect those places known to drift badly. Our equipment for snow removal consists of 286 one-man maintenance units, 56 Caterpillar tractors—18 of which are equipped with plows and the remainder with graders—and 62 trucks equipped with high-speed plows.

During the winter of 1928-29, we spent $53,825.65 for snow removal and $90,885.33 for drift prevention. The last figure includes the cost of snow fence, posts and hardware purchased in 1929.

By means of the foregoing methods we have been able to keep our entire system open practically all of the time. In the few instances where traffic has been tied up, the delays have been of very short duration.



*The Morning After—Near Alliance, Neb. Fence Here Would Have Prevented This Drift*

# Clearing Tennessee Pass

By Geo. F. Toupain
*Assistant Superintendent of Maintenance, Colorado State Highway Department*

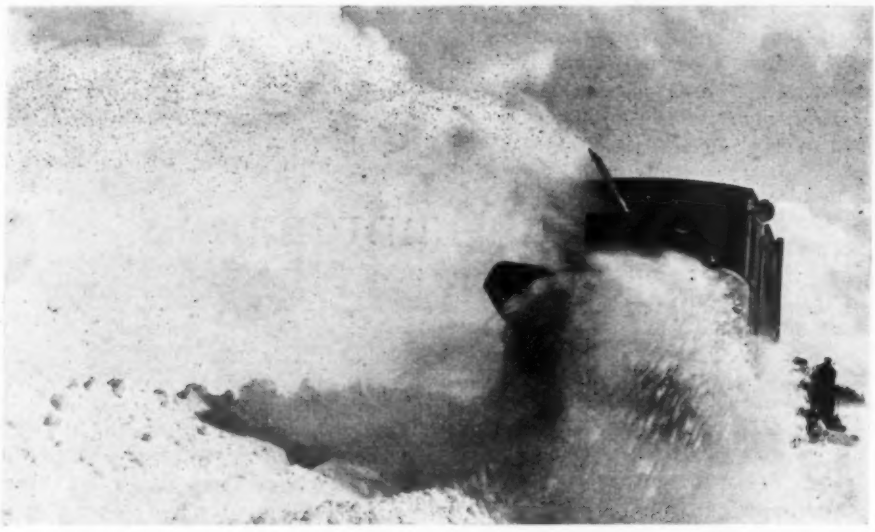
TENNESSEE Pass through the Rocky Mountains in Colorado crosses the Continental Divide and is the main artery between the eastern and western parts of the state. It was closed only six hours during the past winter. Successful organization spirit, coupled with hard work, long hours and conditioned equipment is the secret of this important accomplishment.

Equipment for handling the task, consisting of six Monarch 50 tractors, one Cletrac 100 and a rotary snow plow, was distributed over 120 miles, of which a 14-mile stretch is over 10,000 ft. in elevation.

Each of the tractors was equipped with a one-way-blade push plow, 10 ft. long and 42 in. high, with the exception of the Cletrac, which had a one-way blade, 14 ft. long and 60 in. high. The rotary plow was built by Maj. L. D. Blauvelt, state highway engineer, and is mounted on a 5-ton Coleman truck. This 4-wheel-drive unit has a 110-hp. engine to drive the rotary plow as a separate unit, and can go through 10 ft. of fresh snow at the rate of 3,000 lin. ft. per hour. Since the plow is mounted on the rear end of the truck, it is necessary that the outfit back into the work. The plow is 8 ft. in diameter. It operates nearly perfectly in light snow of almost any depth.

In employing these units, the snow is pushed to the edge of the road by means of the push plows until it begins to block the crew. Then, between storms, the men clean up with a rotary plow, thus getting ready for the next storm.

During the winter of 1930-31 the department expects to add three 4-wheel-drive trucks to its equipment. They will be equipped with one-way push plows and will be used for rapid work.



*Business End of Rotary in Acton on Tennessee Pass*

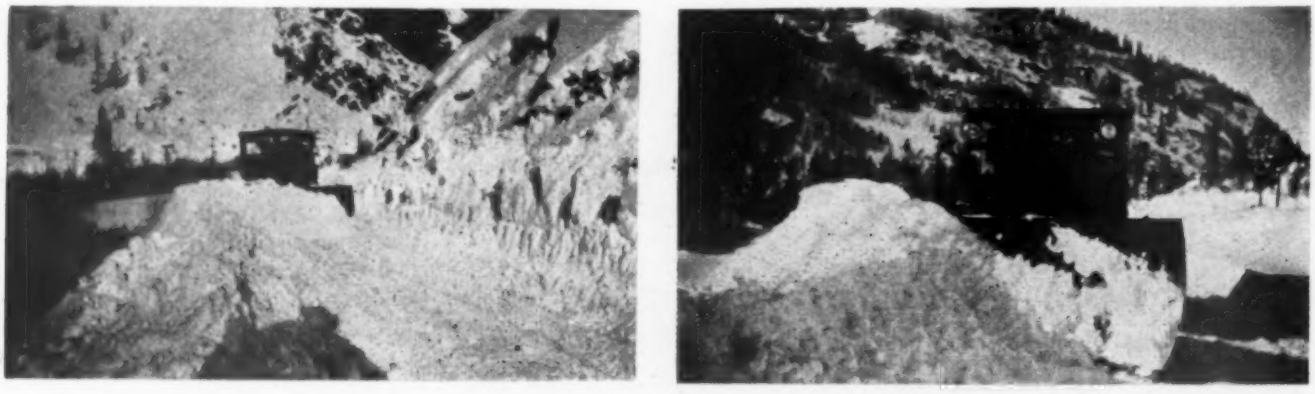
# County Keeps Units Under Cover During Snowstorm

By Louis F. Levin
*County Engineer, Chippewa County, Mich.*

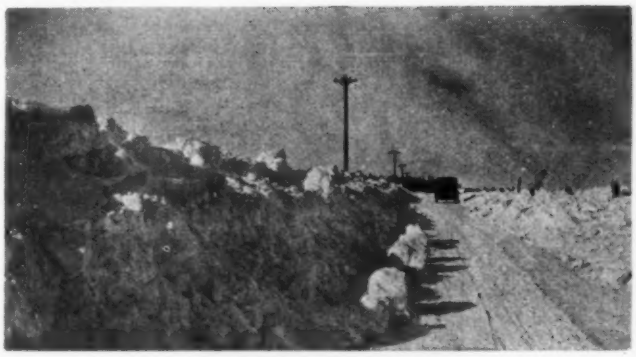
CHIPPEWA COUNTY, MICH., has maintained its state trunk-line highways for winter snow removal during the past four seasons. This work has been done under the customary maintenance contract between the state and the county road commission.

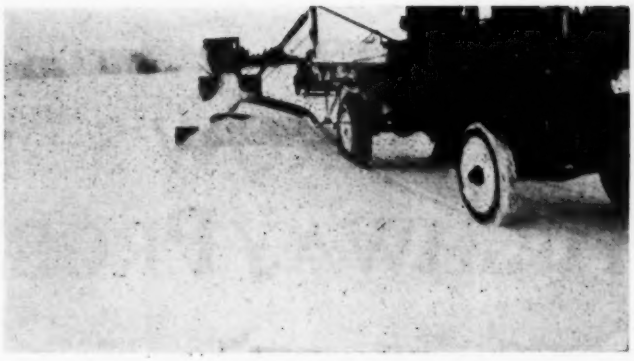
*Wind-Driven Snow Principal Problem.*—During the past winter we maintained wheel traffic on 171 miles of highway. Snow removal by 3½-ton, 2-wheel-drive trucks generally begins about Nov. 15. These trucks are equipped with V-plows of the usual type. This type of equipment ordinarily will handle the work day and night until Jan. 1, when the bank height on each side of the road makes it necessary to bring out the heavier equipment. It is our experience that the amount of snowfall is not as serious a matter as the wind-driven snow. After the side banks have reached a height of about 30 in., the accumulation during the period of a storm is more than the trucks can handle and still maintain the speed required for efficient displacement.

As heavier equipment we have six tractor units mounted with V-type



*Monarch and Cletrac Tractors, Equipped with Straight-Blade Plows, Helping to Open Tennessee Pass*





*Left—A Job for a Rotary Plow. Push Plows have Cleared a Driveway, Leaving High Banks That Should Be Moved Right Away. Right—A Novel Type of Side Plow on a Chippewa County, Mich., Highway*

rotary plows, and two auger-type rotaries mounted on truck chassis as manufactured by the Klauer Mfg. Co. Tractors used are 10 ton Cletracs, Caterpillars and Monarchs; also the Linn tractor.

Contrary to the experience of some, we find it less costly and better in the long run to keep equipment in as much as possible during the peak of the storm. During this peak visibility is so low that the road cannot safely be used by the public, and plowing at that time piles up banks that are a handicap later. As a result, much money has been spent with little service rendered.

In protected territory, the per-mile cost can be kept close to $100, while in open, windswept country it is not uncommon to have costs of $400. The average cost in this county is $200 per mile, with a program continuing until March 15.

# *History of the* Minnesota Snow Plow

*By* W. F. ROSENWALD
*Maintenance Engineer, Minnesota State Highway Department*

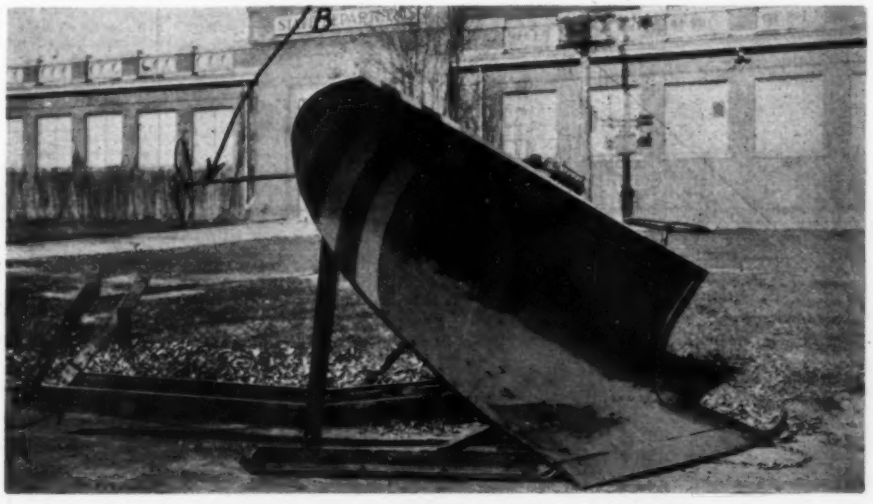
THE snow plow which is now generally used on trucks by the Minnesota Department of Highways is a development over a period of years, during which time we used many known makes of plows, and made some ourselves, besides.

We had difficulty with them in that the plows generally were designed to push out the snow. This not only was wasteful of power but also made operation slow, with the result that the snow was pushed up in ridges at the roadside which only collected deeper snow during succeeding storms. It was evident that it would be necessary to change the shapes of plows so that they could be operated at much higher speeds and throw the snow so that piling it up would be avoided.

*High-Speed Plows.*—We began to modify the shapes with this in view. About this time Otto Erickson, at Virginia, Minn., got out a snow plow of rather light construction with rakish lines, which required less tractive effort and could be moved at much higher speeds. This plow was practically the basis for our present design, which was developed in our own shop. The weight was slightly increased, the plow strengthened in the structural details and the shape somewhat modified by experiment. A simple hitch and lifting device, interchangeable for all our trucks, was worked out. This plow can now be successfully operated at any speed up to about 35 m.p.h.

Practically all of our present truck plows have been made in our own shops, since at the time we were not able to find suitable ones on the market. However, we are not in the manufacturing business and as there are now at least four concerns making plows which are practically duplicates of this plow, it is not likely that we will continue the manufacture of our own.

The wing plow also is an evolution from an earlier widener which was a heavy, cumbersome affair mounted on independent skids and towed behind tractors. This, however, was practical only for very slow operation and, as the operation of snow plows became faster, the shape and size of the wing plow decreased until it finally became a wing on one side of the trucks. The wing plow is suspended from the right-hand side of the truck; by means of a power take-off and winch controlled from the cab, the end of the wing can be rapidly raised and lowered by an operator in the cab.




*Side View of Speed Plow Built by Minnesota Highway Department, Showing Balancing Arms "A" and Lifting Device "B." Note Peculiar Warped Shape of Plow Surface and Forward Slope of Top of Plow*

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*by*

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George E. Goodwin, Mem. A.S.C.E. Mem. Am. Assn. Eng.; formerly Chief Civil Engineer, National Park Service, U. S. Department of the Interior.

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# Distributor News

## Wilmington Chosen for Servicised Plant

Fibrated asphalt products of many varieties will be manufactured at a large new plant recently located in Wilmington, Del., by the Servicised Products Corporation of Chicago, it has been announced by the Chamber of Commerce of the Delaware metropolis. Servicised Laboratories, Inc., a Delaware corporation and holding company, owns the new plant. The Servicised Products Corporation of Chicago is the manufacturing concern and will operate it. The companies own and operate four other plants in Ohio, Illinois, Louisiana and Florida.

The property acquired embraces 12 acres of ground and buildings that were formerly occupied by the Standard Arms Manufacturing Company and the Artillery Fuse Company. The new plant was located in "The First City of the First State" following a thorough investigation of the facilities offered in the other eastern territory. Raw materials will be brought in and finished products shipped out through Wilmington's large Municipal Marine Terminal, which, in the six years of its existence, has witnessed the volume of freight moving through it increase more than 1,400 per cent.

Among the products to be manufactured at the new plant are expansion joints, extensively used in the construction of highways; sewer pipe compound, sewer liners, sewer pipe belts; industrial flooring and bridge flooring; protection course, used for waterproofing bridges and other traffic surfaces; saturated felt; asphalt fillers; railroad crossings; rail filler, used for the deadening of sound caused by wheels grinding on street car and railroad tracks; cable trunking; raggle block, used on roofs; and other forms of roofing and asphalt products. The firm's expansion joints are used in the famous duPont Boulevard, which runs the entire length of the Diamond State.

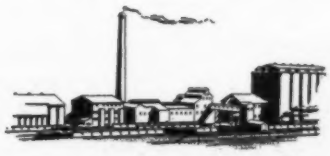
## Three Time Winner of Safety Trophy

Mayor C. F. Snively and R. J. Fisher, president of the Advisory Public Safety committee, of Duluth, were the principal speakers at the recent field day celebration of the Duluth plant of the Universal Atlas Cement Company as winner for the third time of the no-accident safety trophy.

The trophy was presented by George A. Ricker, representing the Portland Cement Association, and was accepted for the Duluth plant by Fred Robinson, assistant superintendent.

A colorful feature of the celebration occurred when 955 gas-filled balloons were brought onto the field by 32 boy scouts, each scout representing one month of the mill's consecutive no-accident record, and after the boys had formed the letters "SAFETY" the balloons were simultaneously released.

Each of the balloons carried a tag bearing a safety message, a "Safety Crusader" badge of the National Safety Council, and a reproduction of a safety poster. Prizes were offered to the finders of the balloons traveling farthest from the



Duluth plant. Each tag carried the name of an employe, and prizes were awarded to the employes whose balloons traveled farthest.

Following the ceremonies attendant upon the unveiling of the trophy, a picnic luncheon and athletic events completed the program.

## All Roads Lead to Bucyrus

When the Great Warco Spirit, which presides over the destinies of the sales organization of the W. A. Riddell Company, makes its annual manifestation late in August there is a gathering of the tribes; and company executives, salesmen and distributors sit about the camp fire to smoke the pipe of friendship and tell of deeds accomplished and plan for those to come.

Rumor has it that the conference of 1930 was all that a sales conference could be in the way of inspiration for the tasks ahead, and in the comradeship established between the different branches of the Riddell company, all of whom are pledged to the distribution of Warco products through the length and breadth of the land.

Twenty-six distributors and their salesmen, representing seventeen different sales organizations, were registered during the conference, and the average attendance of every session was fifty.

The conference was opened with an evening banquet at the Elks Club, where the guests were welcomed by Arthur Schuler, mayor of Bucyrus. One of the guests of honor was the mayor of North Little Rock, Arkansas, Ross M. Lawhorn, and the principal speaker of the evening was Charles M. Newcombe, whose topic was "What Are You Afraid Of." During the course of the evening N. E. Jersey, sales manager, was surprised by being presented with a golf bag, in commemoration of his birthday, and H. S. Allis of the H. S. Allis Company of New Haven, Connecticut, received a hand chased silver dish for attaining the highest point in record of sales. R. S. Spencer, Warco field man operating in the territory of Cuyahoga Equipment Company and Brinker Supply Company, also came in for sales recognition, in the form of a cash gift.

Factory problems and policies, advertising program and development of products were all fully discussed, and testing field demonstrations were held. The second evening of the conference was capped by a dinner at the Harding Hotel at Marion and attendance at "Animal Crackers," and the last day was finished off with a barbeque supper at the Bucyrus Country Club, where the afternoon was spent in golf and other athletic forms of recreation. Golf prizes went to C. H. Brinker of the Brinker Supply Company, Pittsburgh; E. R. McCollough, county surveyor of Tuscarawas County, Ohio, a guest; and H. O. Penn of the H. O. Penn Machinery Company of New York.

On the last evening of the conference Mr. W. A. Riddell, president of W. A. Riddell Company, was taken by surprise when H. S. Allis, as spokeman for the entire sales organization, presented him with a wrist watch. The salesman poet of the organization, F. C. Eldred, struck an optimistic note in rhyme from which we extract:

"Conditions come in cycles
'Tis right and should be so;
The wise man saved his money
The unwise let his go.
"So 'buck up' Mr. Sobber
Go out and do your stuff;
The wise men have the money
Though getting it is tough."

*Sales Organization of W. A. Riddell in Conference*

Upper left: A demonstration at the testing field. Upper right: H. S. Allis of H. S. Allis Company, New Haven, Connecticut; Herman Ehlig of Valley Equipment Company, St. Louis, Missouri; L. M. Cauble, G. F. Marskell and E. J. Anderson, taking life easy on tee-off at Bucyrus Country Club. Upper left: From left on green number 5, W. A. Riddell, H. O. Penn, C. H. Brinker and G. M. Schmidt. Lower right: Barbequed steaks and trimmings, al fresco. Mr. Riddell and Sales Manager Jersey in foreground.

## Distributors in Far Northwest Over Twenty Years

The B. C. Equipment Co., Vancouver, B. C., who have recently taken on the distribution of McCormick-Deering tractors and the Trackson line of Crawlers, Shovels, Cranes, Hoists, etc., are one of the oldest eqiupment firms in the Dominion. They have been in business in British Columbia for more than twenty years and are well known to the equipment industry in the United States, as well as in Canada.

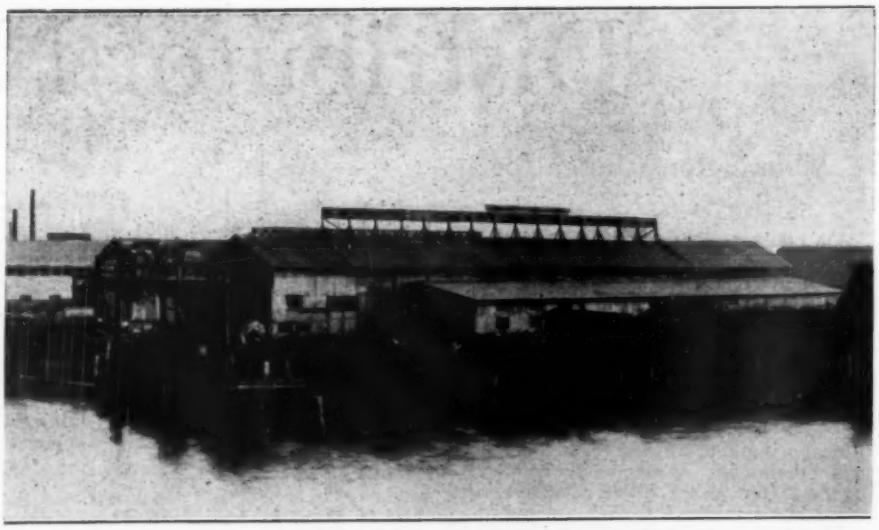
At the head of the B. C. Equipment Co. are S. J. Crocker, manager; F. A. Dietrich and G. W. Tornroos, who together organized the company and are still actively engaged in its operation. Another veteran equipment man, Norman C. Cruikshank, is the manager of their tractor and equipment department.

In addition to their main offices and showrooms at Vancouver, they also have a large warehouse and shop in the city, and a branch office at Nelson. A staff of thirty is employed at Vancouver and three men work out of the Nelson office.


*Offices and salesroom of B. C. Equipment Company, Vancouver, B. C., Canada.*

These distributors are in close touch with highway and other government and municipal officials, contractors, the mining industry, loggers, etc., and are finding a very big field for the lines they represent.

In addition to the International Harvester Co. and The Trackson Co., they represent the Gardner-Denver Co., Climax Engineering Co., DeLaval Steam Turbine Co., Dominion Road Machinery Co., Ransome Concrete Machinery Co., London Concrete Machinery Co., Petters, Ltd., of England, Northwest Engineering Co., S.K.F. Steels, Inc., Sweden, and other well-known manufacturers.



*Warehouse and shops of B. C. Equipment Co., conveniently located on Vancouver waterfront.*

## Personnel Changes at Climax Engineering

F. E. Blanchard, in charge of dealers and service parts organizations and the power unit division of the Climax Engineering Company of Clinton, Iowa, and Chicago, has taken up headquarters at the company's main office in Chicago. This was done to effect greater coordination between his work and other departments of the company.

L. L. Machia, in charge of oil field sales, has changed his headquarters from Clinton, Iowa, to Ft. Worth, Texas. From this new location he will supervise sales in all the oil fields in the country, to which he sells distillate and gasoline burning engines and other forms of equipment.

Forest Dunlap has been placed in charge of Kansas, Oklahoma and Arkansas sales for Climax. His headquarters will be in Tulsa. Mr. Dunlap formerly was affiliated with Clark Brothers Company of Olean, New York, and prior to that was with the Bessemer Engine Company of Grove City, Pennsylvania.

New dealers appointed by Climax for the northwestern United States and western Canada include the following companies: Steeples Engineering Company, Seattle, Wash., of which H. H. Steeples is president; Construction Equipment Company, Spokane, Wash., C. A. Burnett, president; British Columbia Equipment Company, Vancouver, F. A. Deitrich, president; Brown-Frazier Equipment Company, Vancouver, H. E. Brown, president; Hall Perry Machine Company, Butte, Montana, J. S. Perry, president; Commercial Iron Works, Portland, Oregon, W. T. Casey, president. The last named company replaces the former Portland dealer, J. S. Latture Equipment Co.

E. F. Deacon, president of the company, has just returned from an extended business trip, which included Wichita, Oklahoma City, Tulsa, St. Louis, Fort Worth, Dallas and Wichita Falls. Robert Kerr, assistant engineer, and L. L. Machia accompanied him.

### Lee Fills Vacancy on Ohmer Company Board

At a recent meeting of the board of directors of the Ohmer Fare Register Company, Robert C. Lee of the Guardian Trust Company of Cleveland was elected director to fill a vacancy. Other directors of this company are John F. Ohmer, H. B. Ohmer, John P. Breen, John S. McIntire and H. W. Baker of Dayton; Freeman C. Allen of Rochester, N. Y.; F. J. Lisman of New York City and John F. Ohmer of Los Angeles.

Steady progress of the company's business is reported and the directors are exceedingly optimistic for the future.

*"They're in the Army Now"*

**A fleet of thirty two-ton capacity trucks, built up on specifications of army engineers, on their way from Clintonville, Wisconsin, the home of their makers, the Four Wheel Drive Auto Company, to Camp Holabird, Maryland, from whence it is understood they will be distributed to the various government air ports of the United States, Hawaiian Islands and the Phillippines.**

**They will be used for carrying oil and fuel supplies to planes, and during the winter for snow removal where such work may be necessary. Each truck will carry about 500 gallons of gasoline, in addition to large supplies of water, oil, air for landing gear, fire extinguishers, searchlights, and other accessories. Each truck also carries a special heating apparatus for cold weather. The gasoline, water, and air pumps are worked by the truck motor.**

## Fred F. Smith

Fred F. Smith, assistant director of sales, Explosive Department, Hercules Powder Company, died Saturday, Sept. 6, as the result of a heart attack after an illness of several days. Mr. Smith was 48 years old.

Born in Eldorado, Kansas, Frederick Fletcher Smith spent his early career in Kansas and Missouri. In 1908, he left the employ of the Missouri Pacific Railroad to become traffic manager of the Independent Powder Company at Joplin, Mo. In a short time he became assistant sales manager of this company, and in March 1914, when the Independent Powder Company was acquired by the Hercules Powder Company, he went to Wilmington, Del.

For several years, Mr. Smith was assistant sales manager of the Hercules Powder Company, and for the past two years he has been assistant director of sales in the Explosive Department. He was well-known in the explosives industry, having taken an active part in the affairs of The Institute of Makers of Explosives. A quiet but efficient worker, he was held in esteem by his business associates. He had many warm friends in Wilmington and former places of residence.

He is survived by his mother, Mrs. William E. Smith of Eldorado, his sister and brother of the same city; his wife, Mrs. Zoe Boucher Smith, and his son, Wallace Howard Smith, a senior at Princeton University. He was a member of the Wilmington Country Club and several other organizations.

## Regular Quarterly Dividend Declared by Sterling Truck

The forty-ninth consecutive dividend to be declared on the Sterling Motor Truck Company's outstanding preferred stock was issued payable October 1st to stockholders of record September 20th. The amount paid was 50 cents a share on convertible preferred stock.

Officials of the company report greatly improved sales activities during the last sixty days with many good sized fleet sales made to prominent truck operators in all sections. As a result, it is stated that August closed as one of the biggest sales months of the year with a goodly number of unfilled orders carried over into September. Sales to date are reported to be 17 per cent greater than the last three years average, with every indication of improvement during the last quarter of the calendar year.

## J. A. Cordeal Retires from Western Wheeled Scraper

Announcement has been made of the retirement of J. A. Cordeal, from the Western Wheeled Scraper Company, after nearly forty years of faithful service. Mr. Cordeal, who had charge of the St. Louis branch of his organization, has been succeeded by R. A. Ruble, who has been transferred to St. Louis from Atlanta.

Mr. Cordeal was well known in the earth moving field, not only in this country but in Argentina, South America, where he represented the Western Wheeled Scraper Company for many years.

The warehouse stock of Western tools, machines and repairs in Atlanta will be handled through the warehouse of the Austin-Western Road Machinery Company, 389 Whitehall Street. The Atlanta office of the Western Wheeled Scraper Company will remain in charge of Mr. Ruble.

## Trackson Announcement

The Trackson Co., Milwaukee, Wis., announces the appointment of B. Hayman Company, Inc., 118-128 N. Los Angeles St., Los Angeles, Calif., as distributor of Trackson Tractor equipment for the Model U Allis-Chalmers Industrial Tractor. This company will be able to give prompt service on orders for these machines, as well as for repair and replacement parts.

## *Mr. Bacon's Business Family*

*Seated in the center of the first row is Edward R. Bacon, president of the Edward R. Bacon Company, surrounded by the personnel organization serving at the San Francisco headquarters of this well-known firm of distributors. Our readers, no doubt, are well acquainted with many of this group. We think we recognize Mr. Curtis and Mr. Hartley, in the front row.*

## *At Their San Francisco Headquarters*

*Offices and display rooms of the San Francisco headquarters. Just one of the several branches of this West Coast distributing organization.*

### Iowa Mfg. Company Opens Eastern Office

Announcement has been made of the opening of a new branch office in Cambridge in the interest of the eastern trade of the Iowa Manufacturing Company. H. F. Saxton, well known throughout the eastern territory, is manager of the new office. Headquarters of the Iowa Manufacturing Company are loacted in Cedar Rapids, Iowa.

**Climax Engine Service Company,** 115 Broad St., New York City, has been appointed service representative of the Climax Engineering Company of Clinton, Ia., and Chicago. This representative succeeds John H. Reiner Company, and will handle repair parts for all the organization's products.

# ROADS AND STREETS

*Design, Construction, Maintenance and Traffic Control*

H. P. GILLETTE, *Editor*



*Established 1906*

*Vol. LXX, No. 11*

*An Antiquated Method, but Better Than No Gravel at All*

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